THE Principles of Geometrie, *Astronomie, and Geographie.*

Wherein is breefely, euidently, and methodically deliuered, what-*soeuer appertaineth vnto the know-*ledge of the said Sciences.

Gathered out of the Tables of the *Astronomicall institutions of Georgius Henischius.*

By *Francis Cooke.*

Appointed publiquelye to bereadin *the Staplers Chappell at Leaden hall, by* the Wor. *Tho. Hood*, Mathematicall Lecturer of the Cittie of Lond-.

AT LONDON
Printed by *Iohn Windet*, and are to be solde in Mark lane, ouer against the signe of the red Harrow, at the house of *Francis Cooke.*

To the VVorſhipful wel-willer and practiſer of the Mathematicks, M. *Bernard Dewhurſt*.

OUr courteſies (worſhipful) inexpected, haue brought me very farre in arrerage with you, and I haue thought the time ouer long, vntill in ſome ſort I might break ſilence, and ſay ſo. But better late then neuer, as the prouerb goeth, and yet perhaps as good not at al, as not as it ſhould be. I haue intẽded many waies according to the courage of a ſcholler, to be euen with you, or at leaſt to ſhew ſome ſign of gratitude, but it would not be: and therefore haue I reſted ſo long vpon hope of ſome fit oportunitie, which now being fitly offered, I haue accordingly taken holde of: I preſent therfore this little booke vnto your Wor. little I meane in bodie, but full of ſubſtance and matter: according to the

commendacion which the Poet giueth to *Tydeus*, the Father of *Diomedes*, and that was that *Tydeus*, *Ingenio magnus, corpore paruus erat*. A little fellowe, but full of edge. I commend it vnto your Wor. although the praise therof shall rather proceede from it selfe, then from me, vnlesse I could praise it worthily enough. I found it els where, and otherwise attired, and my labour and charge is onlie in this, that I haue bestowed thereon a new coate after our English fashion, obseruing the matter, only altering the manner. Accept it I pray you none otherwise then I mean it, not as a guift worthy enough, but as some little signe of a thankfull minde, which according as power shalbe answerable vnto any good occasion, I will more manifestly declare in some greater matter.

Your Worships wholy.

F. Cook.

To the learned and worshipfull. *Tho, Hood* Mathematicall Lecturer of the Cittie of London.

AMong many your ſchollers whoſe diligence haue made them more able: I haue aduẽtured to put forward my ſelfe, being of all other moſt vnfit and inſufficient. My purpoſe herein is not the gaining of mine owne commendation, but to cõmunicate that with others, which I finde beneficiall vnto my ſelfe. The commendation is wholy yours, from whome as from the Sunne we receaue, as in theſe exerciſes, all the light we haue. And hereunto may be added another cauſe of this my bold enterpriſe, namely, that others, who are better furniſhed, may by mine example, being a nouice in theſe ſtudies, make proofe vnto the worlde, that your labours are not in vaine, but that there are many which haue greatly profited thereby, and which in due time (I hope) will breake forth, both to the great commoditie of the common wealth, and commendation and credit of the Mathematicall Lecture. Take in good parte (I pray you) theſe my firſt fruites of your owne planting, and make fauourable conſtruction thereof, correcting the faults, and pardoning my boldenes.

Your Scholler in this caſe more forward then able. F. Cook.

To the louing and diligent Auditors of the Mathematicall Lecture.

GEntlemen and Goodfellowes, and to ioyne you both in one, men and schoolfellowes: I haue as you see aduentured to flye, although both fitted with the feathers of another, and lying but a lowe pitch, for want of winges, If I shall seeme to any of you too forward, I craue his pardon, it is my first fault, I meant no hurt: If any man will charge me of defects, I will confesse my wants, and submit my selfe vnto any reasonable censure. Howbeit I look for no hard measure from any, frequenting these exercises, either in the schoole or abroad, inasmuch as they are for the most parte tame beastes that belong to this folde: what the wilde and sauage sorte can or will doo I feare not, I can appeale from them, as in this case, no competent Iudges. I haue after my manner dealt plainely with the matter, and I pray you take it as it is, inasmuch as howsoeuer it deserueth, I can set it out no better. For as one saith.

They that are learned and haue the gift,
may make of matters what they will,
But he that hath none other shift,
must goe the plaine way to the mill.

As in this I haue doone,
Fare you well.

The

¶ The descriptions of Geometricall and Astronomicall termes.

Of Magnitude. Chap. 1.

THere be 3. kindes of Magnitudes, a line, a surface, a body.

In a line, called by the Greekes γραμμὴ, we are to consider the definition, the termes, the sortes.

The definition of a line is two folde: For it is defined to be either a length without breadth, μῆκος ἀπλατὲς, or els the flowing of a point in length.

The tearmes of a line are points: and here we are also to note, the distinction of pointes, and their denomination.

They are distinguished into points Geometricall, and Physicall.

Geometricall points are such as haue no part.

Physicall points be such as may be apprehended by our sight, of which sort are motes in the Sunne shine.

Pointes are denominated either centres and poles, whereof the principall are those of the worlde, of the Zodiake and of the Horizon: or els the Equinoctiall, and the Solstitiall pointes.

For the seuerall sorts of lines look in the 2. Chapter.

In a Surface, in Greek ἐπιφάνια we are to attend the definition, and the termes.

It is defined to be either an extended and broad

broad extremitie, or els length, and breadth without depth.

The termes of a ſurface are lines, whereof in the Chapter following: as alſo of the ſeuerall ſorts of ſurfaces in the 3. Chapter.

A bodie is defined to be breadth, hauing depth adioyned therunto: or a figure conſiſting of 3. dimenſions.

The bounds or limits of a bodie are ſurfaces.

There be many ſorts of bodies: wherof in the latter parte of the book.

Of Lines. Chap. 2.

A Line is either right or crooked.

In a right line note, the definition, and the diuers kindes therof.

A right line is defined to be, either the ſhorteſt extenſion from one point vnto another: or els, the ſhorteſt of thoſe lines that haue the ſame limits.

There are 4. ſortes of right lines.

The firſt diuideth a figure into 2. equall or vnequall partes.

Right lines diuiding a figure into 2. equall partes, are either diameters, namely in a ſquare, or in a circle: or Axes, as in a Spheare: or els diagonales, as in *Polygons*.

Right lines diuide a figure into 2. in equall partes, as chordes in circles, the halfes wherof are called Sines.

The ſecond ſorte of right lines are thoſe that bound the figure, whereof thoſe that limit the

vpper

vpper parte, are called *Corauſci*: thoſe that boũd the nether parte, are called the *Baſes*: thoſe that include the laterall partes, are called *Coſta*, the ſide lines.

The third ſort of right lines are ſuch, as are eleuated either perpendicularly, or not perpendicularly.

Right lines perpendicularly eleuated, are called perpendiculars, plumb lines, ſquire lines, orthogonall lines, or lines at right angles.

Right lines not perpendicularly eleuated, are called Hypothenuſalles or ſubtendent lines, alſo oblique lines: likewiſe viſuall lines, or viſuall beames.

The fourth ſorte of right lines, are ſuch as are equidiſtant, as paralleles.

In a crooked line conſider the definition, and the ſortes therof

It is defined to be the running of a point vnto a point, not by the ſhorteſt, but by a longer way.

The ſortes thereof are many: whereof ſome are ſimple, and ſome mixt.

Simple crooked lines are ſuch as are made by a point running round, as in the circumference of a circle, of a ſemicircle, and of an arke of a circle.

Mixt crooked lines are ſuch as compaſſe not a circle: and they are either winding, or ſpirall.

Winding lines are ſuch as in their partes are inequallie eleuated from the midſt.

Spirall lines are ſuch as being wound round about either ſome centre in a place ſurface, or ſome piller, as we may ſee in cylinders and the

scrues of presses, do neuer returne vnto the same point from whence they began.

Of Surfaces. Chap. 3.

SVrfaces are either plane, or Spherical.

Plane surfaces are such as are limited equally either with right, or els with crooked lines.

Plane surfaces limited equally with right lines, are such as haue either 3. or 4. or more right lines for their limits.

Plane surfaces equally limited with 3. right lines, are triangles, which haue their denominations either from the lines that inclose them, and then they are saide to be of equall sides, of equall feete, of inequall sides and feete: or els from their angles, and so they are said to be right angled, obtuse angled, acute angled.

Plane surfaces equally limited with 4. right lines, are either parallelogrammes, wherof some are squares, some long quadrãgles, some Rhombes, some Rhomboides: or els, they are Trapezia, or Tables.

Plane surfaces equally limited with more thé foure right lines, are of many sortes, as a Pentagon, an Hexagon, &c.

Plane surfaces equally limited with crooked lines, are circles, whose partes are called arkes, portions, or sections, a semicircle, a quadrant, a segment, or a sector of a circle.

Arkes are partes of the circumference of a cir-

cle

cle ſeparated by chords.

Portions or ſections are the greater and leſſe ſurface of the circle, diſtinguiſhed by a chord.

A ſemicircle is that which is conteined vnder the halfe circumference, and the Diameter.

A quadrant is the fourth parte of a circle, included within 2. ſemidiameters.

A Segment or ſector of a circle, is a figure conteined vnder an arke of the circumference, and 2. right lines drawen from the centre.

Sphericall ſurfaces are ſuch, as are limited and conteined vnder inequall, that is, vnder depreſſed and eleuated lines.

Sphericall ſurfaces are either conuexe, or concaue.

Conuexe ſphericall ſurfaces are ſuch, as doe bound the body on the outward parte.

Concaue ſphericall ſurfaces are ſuch, as do limit the body on the inward ſide.

Of Angles. Chap. 4.

AN Angle is made by the alternate or croſſe meeting of lines or ſurfaces.

An Angle is either ſuperficiall, or ſolide.

In a ſuperficiall angle there are to be conſidered, the definition, and the diuiſion.

A ſuperficiall angle is defined to be the touch of two lines, the one inclining to the other in one ſurface.

Superficiall angles are diuided two waies, for they are conſidered either by them ſelues, or reatiuely.

Superficiall angles conſidered by themſelues, are either plane, or ſphericall.

Plane ſuperficiall angles are ſuch as are drawen vpon a plane ſurface, and they are either right lined, or crooked lined, or mixt.

Right lined plane ſuperficiall angles are ſuch as are made by right lines onely, and thoſe lines are either perpendiculare, wherof a right angle is made, which is alwaies equall vnto the right angle next adioyning vnto it ſelfe: or not perpendiculars, wherof is made either an acute angle, leſſe then a right angle, or an obtuſe angle, greater then a right angle.

Crooked lined plane ſuperficiall angles are ſuch, as are made of crooked or bowed lines onely.

Mixt plane ſuperficial angles, are ſuch, as one right and one crooked line doth make.

Sphericall ſuperficiall angles, are ſuch as are drawen vpon the conuexe ſurface of the ſphere, differing according to the compaſſe of the greateſt circle, deſcribed from the very toppe of the ſection.

Superficiall angles are conſidered relatiuelye when they are compared with others, in whoſe reſpect they are called ioynt angles, verticall, alternate, and oppoſite angles.

Ioint angles are ſuch, as a right line falling vpon a right line, maketh on either ſide.

Verticall angles are ſuch, as the mutuall ioyning together of two lines, doth make on contrary partes.

Alternate angles are ſuch as one line falling vpon

vpon 2. dooth make both on the right and lefte hand of either of them, aſwell within as without.

Oppoſite angles are thoſe that can haue no relation vnto any one of the former.

A ſolide angle is that which is conſidered in ſolide bodies, conteined vnder more then two plane angles, not ſituated in one and the ſelfe ſame ſurface.

Of Bodies. Chap. 5.

THe kindes of the third magnitude which is called a bodie, are diuerſe: ſome are regulare, others are Irregulare.

Regulare bodies are ſuch as are limited by equal ſurfaces, the which ſurfaces are either turned round, or foulded one toward another.

The ſurfaces turned round, are either the equall ſections of circles, or right lined figures.

Equall ſections of circles, are ſuch as either fil vp the whole plane, and by them the ſpheres are made, or els they are cut out hollowe in the midſt, wherof are made orbes, either vniformed or difformed.

Right lined figures limiting regulare bodies, are either right angled triangles, wherof Pyramides are made, whoſe vpper parte is called the Cone, or toppe, and the nether parte and plane ſurface is called the baſe, or ſquare or quadrangulare figures on the one ſide longer, from whence are deriued figures long and broade, as pillers, or cylinders: or els they are of other ſortes,

tes, which are infinite, from whence diuers formes and kindes of bodies are drawen.

The regulare bodies conteined vnder surfaces, folded one toward another, are onely these 5. the Tetraedrons, the Hexaedrons, the Octaedrons, the Dodecaedrons, and the Icosaedrons.

Irregulare bodies are such, as inequall surfaces do limit and describe, the which surfaces are either turned roũd, or folded one toward another.

The surfaces turned round and making irregulare bodies, are either the sections of circles, or els they are inequall right lined figures.

The sections of circles, are either greater then a semicircle, wherof the lenticulare bodies are made: or els they are lesse then a semicircle, and therby are the Oualles made.

The inequall right lined figures by whose cõuersion the irregulare bodies are made, may be of what sorte soeuer, wherby diuers kindes of vessels are framed, either wanting or exceeding the regulare forme.

The Irregulare bodies màde of inequall surfaces folded one toward another, may differ infinitely.

Of the name and definition of the Sphere. Chap. 6.

IN as much as we make often mention of the Sphere, and thereafter do intitle this present treatise the doctrine of the Sphere, it shall not be amisse to declare the name, and the definition therof.

The name is vsed in diuers significations.

1. It

1. It ſignifieth ſometime any ſolide regulare bodie, limited with one ſurface onely.

2. Sometimes it ſignifieth an inſtrument that doth iuſtifie the apparences of heauen, and conteineth the celeſtial circles, and is otherwiſe termed a ring or materiall ſphere.

3 Sometimes it ſignifieth the whole worlde, wherunto all the cõditions of the ſphere may be applied: For it is a ſolide bodie, wherin nature abhorreth that any emptines ſhould be giuẽ: It hath a ſphericall forme running dayly about his owne Axis without intermiſſion: It hath a point placed in the midſt therof, namely the earth.

The definition thereof, as it ſignifieth any body, is by *Io. de ſacro baſco*, ſet downe two waies, the one after *Encl.* 11. *Elem.* the other out of *Theodoſius.*

The definition thereof taken out of *Euclide*, conteineth the Geometricall deſcription of the ſphere: For the ſphere is deſcribed' by the fixed and vnmoued diameter, and by the arke of the ſemicircle, which muſt be fully brought about.

The definition of a ſphere according to *Theodoſius*, determineth, firſt the orbiculare forme, euery parte whereof is equally diſtant from the centre: ſecondly the principall partes, as the conuexe ſurface which is but one, and the centre, that is, the point in the midſt equidiſtant from euery parte of the ſurface, and the Axis, about which the ſphere is tourned, and which is limited by the 2. poles. viz. The North pole or pole Arctick, and the ſouth pole or pole Antarcticke: and thirdly, the ſoliditie: For it is a complet

plete body, hauing all the dimensions.

The diuision of the celestiall Sphere. Chap. 7.

THe celestiall sphere, according to *Io. de sacro bosco*, admitteth a double diuision, according to substance, and according to accident.

The celestiall sphere considered according to the substance, is diuided into seuerall orbes, in the which we are to note the number, and the cause.

The number is diuersly set downe: For the ancientes contenting themselues with 8. orbes only, did distinguish them into the orbes of the 7. Planets, viz. of ♄ ♃ ♂ ☉ ♀ ☿ and ☽, and the firmament of the fixed starres: And the later Astronomers vnto the time of *Alphonsus*, into 9. orbes: but the Moderne, among whom *Purbachius* was the first, added the tenth.

The cause is considered either in the diuersitie of their number, noted both by the former and later Astronomers, or in their order.

The ancient Astronomers noted their diuers number, either by the brightnes of the Starres, reconing so many orbes as they perceiued to conteine any starres: or by the peculiar motion of each seuerall orbe, reconing so many orbes as they found simple motions belonging thereunto.

The later Astronomers, for instruction and the better reconings sake, added the ninth and the tenth, as circles necessarye for the vnderstanding of the motion of the 8. sphere, vnknowne vnto the

the ancient Aſtronomers.

The order is proued, 1. by the ſlower motion of the higher, and the ſwifter motion of the lower orbes: 2. by the occultation or hiding of the higher ſtarres, by the lower: 3. by the diuerſitie of apect, either great, or little, or inſenſible.

The celeſtial ſphere conſidered according vnto accident, that is, according to the ſituation of the heauen, or the courſe of the ſtarres, is diſtinguiſhed into a right, or an oblique ſphere.

The right ſphere belongeth vnto thoſe that dwell vnder the Equinoctiall, who (by reaſon that the poles of the world, about the which the ſtarres are carried by the firſte moueable, haue none eleuation, as alſo for that the Horizon cutteth all the paralleles, vnder which the ſtars do goe, at right angles) perceiue no reflexion in the diurnall motion of the ſtarres.

The ſphere is ſaid to be oblique, wherein the ☉ and the reſt of the ſtarres are caryed from the Eaſt into the Weſt, by an oblique motion, and it is Septentrionall vnto thoſe that haue the North pole eleuated, and Meridionall vnto thoſe vnder the Southerne eleuation.

The partition of the whole worlde: and the compariſon of the celeſtiall, with the Elementall Sphere. Chap. 8.

THe whole frame of the worlde is made of ſome certain and thoſe more principall and notable partes, wherof there is firſt the number

and the name, and then the difference to be considered.

The number and name is double: For the partes are either ethereall, or sublunare.

The æthereall that is, the celestial parte (without the which Philosophie admitteth nothing to be, although the Diuines do adde the third, which they call Angelicall, and the Platonickes, intellectuall) is that, wherof we intreated in the 7. Chapter.

The sublunare is that which conteineth the elementall bodies, and those either simple, as the fire, the aer, the water, the earth: or els mixed, which are diuerse and innumerable, ingendred of the 4. elementes, either perfect or imperfect.

The difference or dissimilitude of the partes of the worlde is that, whereby they are distinguished one from another, either in respect of their situation, or of their dignitie, magnitude, motion, or their office.

They are distinguished according to their situation: For the celestiall parte hath obteined the higher place, the elementall the lower.

Their distinction according to dignitie, is noted in the partes conteined by the celestiall Region, which partes are bright and immortall, and by the elementall region, those partes being of their owne nature obscure and decaying: or els, it is noted in the partes conteyning, wherof the one is altogether without alteration, neither increasing nor diminishing, the other is continually subiect vnto generation and corruption,

and

and is increaſed and diminiſhed.

Their diſtinction according to their magnitude is conſidered, in that the celeſtiall parte with the great compaſſe thereof, doth couer all thinges, like a thing without meaſure and ende: but the elementall parte is couered within the compaſſe of the heauen, the diameter thereof conteining the diameter of the earth, 23. times.

Their diſtinction according to their motion, is in that the celeſtiall parte hath a circulare, and a ſphericall motion: the elementall, a right motion, more imperfect then the circulare.

Finally, they are diſtinguiſhed according to their office? For of thoſe thinges that are ingendred in the elementall parte, the heauen, working by a continuall motion, is as it were the formall and efficient cauſe, from whence life is deriued: and the elementall parte, which is ſubiect vnto paſſion and alteration, is as it were the materiall cauſe, from whence nouriſhment doth proceede.

The reaſon of the ſublunare, or elementall Region. Chap. 9.

THe Elementall region, which the heauen encompaſſeth, comprehendeth within it the elements, wherin we are to conſider the definition, the number, and the ſituation or order.

The elements are ſimple bodies, aſwell in reſpect of the mixt bodies which are vnderſtoode to be compounded of them, as of the ſimple and leaſt partes: as alſo in reſpect of the diuiſion, for

that they cannot be diuided into bodies of diuers kindes (if they be giuen pure and without mixture. For the vse of liuing creatures, and things growing doth make them impure.)

The elements are 4. in number, found so to be, by sense, and by reasons.

The elements are found to be foure by sense (which the Physicians doe follow): First for that more simple bodies cannot be shewed: 2, nature hath alotted vnto them certaine places, to the end that other things might by thē be bred, and nourished: 3, nothing els can euidently be shewed, wherof other things may be made: 4, in liuing cretures there are certain parts, agreable vnto the natures of the seuerall elements.

The Elementes are found to be foure, by two reasons: the former whereof is drawen from the number of the foure prime qualities, and the foure folde possible knitting together of them. For heate may be ioyned either with drinesse, which two make fire, or els with moisture, which two do make vp aer: and colde may be ioyned with moisture, as it commeth to passe in the water: or with drinesse, as in earth. The later reason is taken from the fower folde difference of the right motion: For the elements are directly moued, either vpwarde or downward.

Such things as moue vpward as light thinges do, are said so to do, either simplie, as the fire, which is the lightest of the rest: or respectiuelie, as the aer, which is lighter then the water, or the earth.

Such

Such things as moue downeward, as heauye things do, are ſaid ſo to do, either reſpectiuelie, as the water compared vnto the fire, and aer: or ſimplie as the earth, which is the heauieſt of all the reſt.

The ſituation and order of the Elementes, is found either by their motion, or els by the communication of their qualities.

And firſt by the motion: For inaſmuch as the fire and the aer do naturally moue vpward, the fier ſhall occupy the higheſt place: the aer, an vpper place: and for that the water and the earth do naturally moue downward, thé water ſhall poſſeſſe a lower place, and the earth the loweſt.

Againe, the order of the Elements is found out by the communication of their qualities, for it were vnfit that ſuch things as are merely contrary, but ſuch as in ſome ſorte can agree together, ſhould be nigh one another. The fire therefore ſhalbe ioyned vnto the aer, by reaſon of the heate common vnto them both: the aer vnto the water, by reaſon of the common moiſture: and the earth vnto the water, by reaſon of coldneſſe common to them both.

The two folde differences, of the celeſtiall motions. Chap. 10.

THe wholeframe of the world is caried round about, with 2. motions, each of them being diſtinguiſhed from the other in name, and in reaſon.

The one of them is called the firſt and vniuerſall

ſall motion: likewiſe the diurnall or worldlye motion, becauſe it bringeth the day vnto the world. For in this motion the ☉ and all the celeſtiall bodies do euery day ariſe and ſet: they call it alſo the violent, and rapt motion, becauſe by the violent ſwiftnes thereof, it carrieth with it the reſt of the Spheres.

The other is called the ſecond and particular motion, altogether contrary vnto the former, as by which all the particular orbes do reſiſt the vniuerſall motion. They call it alſo *Siniſter motus*, the motion to the left hand, as the former is in like ſorte called *dexter*, that is, the motion to the right hand.

The 2. motions are alſo diſtinguiſhed according to the reaſon or the ſubſtance in the which they are inherent: For they differ the one from the other three waies.

The firſt difference is in reſpect either of the whole: For the diurnal motion is common vnto all the celeſtiall bodies: or els of the partes, or ſtarres either fixed or wandring, which haue a motion peculiar and propre vnto themſelues.

The ſecond difference is either in regarde of the ſituation of the Axes, For the diurnall motion is made vpon the Axe and poles of the world, and therfore the Equator diuideth it in the middle: but the propre motion is made vpon the Axe and poles of the Zodiake, and therefore the Zodiake doth cut it in the middle: Or els it is in regarde of the poſition of the termes: inaſmuch as the diurnall reuolution is made from the Eaſt vnto the weſt, or as *Plinie* termeth it,

from

from the right towarde the lefte hand: but the propre reuolution is from the Weſt vnto the Eaſt, or from the left toward the right hand.

The third difference is in conſideration of the ſwiftnes: For the diurnall motion fulfilleth his courſe within the ſpace of 24. common howers: but the propre motion in diuers diſtances of time, according to the largenes of the orbes: namely, the orbe of the fixed ſtarres performeth his circle, in 36000. yeares: of ♄ in 30: of ♃ in 12: of ♂ in 2. yeares: of the ☉ in 365. dayes, and about 6. houres: of ♀ in 384. dayes, after *Plinie*: the orbe of ☿ in as many dayes as the ☉: and the orbe of the ☽, in 27. daies & 8. howres.

The circulare forme, and circulare motion of the heauen. Chap. 11.

THe Heauen is circulare in motion, and in figure.

The circulare motion of the Heauen is proued as well by 2. experiments, as by 2. argumentes.

The one experiment is taken from the ſtarres of the 8. orbe, which both in their riſing & ſetting, do alwaies keepe one & the ſame habitude, both in regarde of the earth, and one to another: which thing can agree with none other then a circulare motion about the centre.

The other experiment is alſo taken from the ſtarres of the 8. orbe, alwaies appearing, and retaining in diuers places the ſame diſtance from the

the Poles, and one from another: which also agreeth with the circulare motion onelie.

The first argument is deriued from the confutation of 2. opinions, wherof the one supposeth that the motion of the heauen is direct and infinite: which if it were, the starres should vanishe out of our sight: The other, that the startes in their setting are quenched, and in their rising are lighted againe: as *Heraclitus* affirmed, which is absurd, both in respect of the motion, which is perpetuall and constant in it selfe: and of the contrary power, which cannot be in the earth: as also in regarde of our Antipodes, whose West is our East.

The second argument is drawen from the dignitie thereof: For the circulare motion is the most worthye, and more perfect then the right motion, inasmuch as it breedeth no scission or cutting, and is made about the midst of the whole, not by displacing the whole bodie, but by the onlie vnchangeable succession of the situation of the partes.

The criculare figure of the Heauen is proued partely by similitude, and partely by reasons.

The similitude is this: namely that this sensible worlde is the image of the first Archetype, or paterne of the worlde, who is without beginning or end.

The reasons do containe either the commoditie of the circulare figure, or the necessitie.

The commoditie consisteth either in the capacitie, or els in the swiftnes or aptnes vnto motion.

The

The capacitie was fit for the heauens, in that they were to comprehend all other things. For the circulare figure is the grateſt of al other, circumſcribed with equall conuexities.

The ſwiftnes or aptnes vnto motion, is either belonging vnto the diurnall motion, called alſo the right hand motion, naturall vnto the Heauens: or els vnto the ſecond motion, which reſiſteth the former.

The reaſons drawen from the neceſſitie of the circulare figure, are either in reſpect of the whole world: For if the Heauen were of any other figure, there muſt needes be ſome emptie place, and a body without a place: or els in regarde of the celeſtiall orbes, which either could not be turned about by diuerſe motions, or els they ſhuld ſuffer a ſciſsion or cutting in ſunder not without their greate hurt.

There is one ſurface of the earth and water, and that is round. Chap. 12.

THe earth and the water make one globe, and it is proued by cauſes either generall, or ſpeciall.

The generall cauſes belong vnto both the elements made vp in one forme, and are deriued from 3. heades.

Firſt from the ſignification of the worde: For both in common ſpeach, and in the ſcriptures, it is called *Orbis terræ*, the Globe of the earth, or the round world.

Secondly, from the Sphericall forme aſwell of

the Heauen, into whoſe round compaſſe inaſmuch as it is included, it cannot be but it muſt alſo be round: as alſo of the ſhadowe that this globe doth caſt forth: For the Maiſters of Perſpectiue do teach vs, that ſuch is the darke bodie as is the ſhadowe therof.

Thirdlye, from the naturall deſcending of the portions, either of the earth, the ſaide portions coueting the centre of the Globe, and falling vpon the ſurface of the earth at right angles: or els of the water, ſinking alſo into the centre of the worlde, for the which their diſcending they gather themſelues into a round forme, and cannot abide vpon a plane furface.

The ſpeciall cauſes are ſuch, as decerne the roundnes of the earth, and of the water particularely.

The roundnes of the earth is decerned two waies.

The one is according vnto Longitude, from the Eaſt toward the Weſt, or contrarywiſe, and that either by all the ſtarres, which in diuers places do not appeare at the ſame inſtant: or els, cheefely by the ☽, whoſe Eclipſe fulleth out at one and the ſame time, but by thoſe in the Eaſt reconed one way, by thoſe in the Weſt, another.

The other is according vnto Latitude, from the Equator towarde each pole, gathered by the vnlike eleuation of the Pole, and inequall quantitie of the daies, both which increaſe vnto thoſe that goe from the Equator towardes the North or South.

The

The roundnes of the water is decerned by tokens deriued from the ſwelling of the droppes, either hanging, or throwen vpon the duſt, or laide vpon the moſſe of boughes: as alſo from the ſwelling of the Sea, by meanes whereof the Land cannot be ſeene from the Shippe below, although from the maine toppe it may: and againe if any ſhining thing be faſtened to the top of a ſhip ſayling farre from the ſhore, it deſcendeth by little and little, according as the Shippe runneth further off, and at the laſt is hidden from the ſight.

The ſituation, immobilitie, and magnitude of the terreſtriall Globe. Chap. 13.

THe earth or globe of the earth and water, hath ſituation, reſt, and magnitude.

The ſituation as being in the centre, or the place of the worlde fartheſt diſtant from the extremities thereof, is proued by arguments either direct, or indirect.

The direct are deriued from the nature of the broken partes, expreſſed either Phyſicallye, or Aſtronomically.

Phyſically, becauſe whereſoeuer they are about the earth, we alwaies obſerue them, that of their owne inclination they tende downeward. But the centre is the loweſt place.

Aſtronomically, inaſmuch as all the ſemidiameters of the worlde, by which heauy thinges deſcende, are continued through the centre of the worlde, and there they cut one another. So

that where the ſection is made, there muſt needs be the place of the earth.

The indirect argumẽts conſiſt in two ſuppoſitions.

The one, that the eatth were in the Axis of the motion of the Heauen towardé one ſide, [& then ſhould be taken away the apparent reaſon of the middle Heauen: the reaſon of the ſhadowes Equinoctiall, Solſtitiall, and plagall: and the reaſon of the vniuerſall Equinoctialles.

The other ſuppoſition, that the earth were without the Axis, remoued from the poles, either to the Eaſt or to the Weſtwarde, and then ſhalbe taken away, both in the riſing and ſetting, the equall quantitie both of the daies, ſhadowes, and ſtarres.

The Reſt of the earth excludeth al locall motion, either right or circulare.

The right motion is that which is made from the midſt, and it is either naturall and peculiar vnto the earth: For otherwiſe it ſhould come to paſſe that heauy things ſhould aſcend: or els it is violent, ſome outward thing inforcing it: For otherwiſe it ſhould come to paſſe, that the earth ſhould forſake the centre of the world.

The earth hath no circulare motion, neither from the Weſt to the Eaſtwarde, as ſome haue thought: For if it had, all things that are moued in the aer, ſhould alwaies be moued to the weſtward: Neither from the Eaſt to the Weſtward, by the diurnall motion: For then it ſhould be an harder matter to trauaile toward the Eaſt, then toward the weſt.

The

The magnitude of the earth is nothing, being compared either with the whole world, wherof it is the centre, which is proued by Mathematicall inſtrumentes that agree with the centre of the world: For they at one time, and through the ſame ſight hole, ſhew two Starres oppoſite in the Diameter: or els being compared but with the orbe of the ⊙, which is proued by the equall ſpaces of the dayes and nights.

The meaſure of the compaſſe of the earth. Chap. 14.

THe circũference of the Globe of the Earth and water is found out by the rule of foure proportionall numbers, in which rule 3. numbers are giuen, and the fourth is vnknowne.

The three numbers giuen, which conteine the proportion of a ſegment of a celeſtiall circle vnto the like ſpace on the earth, are: 1. the difference of Latitude: 2. the viatorie diſtance: 3. the circumference of the whole heauen.

By the difference of Latitude is vnderſtoode, ſo many celeſtiall degrees, as any terreſtrial places are diſtant aſunder.

The viatorie diſtance, is that terreſtriall ſpace of waye, that is anſwerable vnto one degree, or any other difference of Latitude, and it is found out 3. manner of wayes.

Firſt, by the diſtance of any two places vpon the earth, ſituated vnder one meridian, the ſaid diſtance being preciſely tryed.

Secondly, by the latitude of both places, either

ther obserued by instruments, or taken out of Tables.

Thirdlye, by subducting the lesse out of the greater: for so the difference of latitude shall appeare, whereunto the space of way knowen betweene the places geuen, shalbe answerable. Whereby vnto each degree of a great circle in the heauen, there are answerable vpon the earth after *Ptolemee*, furlongs 500. passes 62500. greater leagues 15. After *Eratosthenes*, furl. 700. pass. 87500 leag. 21. $\frac{7}{8}$.

The circumference of the whole heauen (conteining 360. gr.) is the 3. number in the proportion: 1, for that of a little and of a great globe, there is the like reason: 2. because the terrestriall meridian hath the same centre with the celestiall.

The fourth number of the proportion, that is the circuit of the greatest circle in the earth, hath 2. considerations.

The first is the maner of the searching thereof, and that is, first by multiplying the third number, that is, the circumference of the heauen by the second, which conteineth the space of way vpon earth: and then by diuiding the product by the first, which is the difference of latitude.

The second consideration is of the quotient, or manifestation of the content, which according to *Ptolemee* is miles 22550. furl. 180000. pas. 225000000. greater leagues, 5400 according to *Eratosthenes*, miles 61250. furl. 252000. pass. 61250000. greater leagues 7875.

The

The meaſure of the Diameter, and Semidiameter of the earth, as alſo of the Area and Surface thereof. Chap. 15.

IN meaſuring the terreſtriall Globe, wee conder either the Diameter, or the Semidiameter, or the Area, or the conuex ſurface thereof.

The Diameter is meaſured by the proportion thereof vnto the whole circumference, by the rule of foure proporrionall numbers, wherein againe three are geuen, and the fourth is vnknowen.

The three numbers geuen, beeing throughlye knowen and vnderſtood, muſt be duely placed, and they muſt conteine two things.

The firſt is, the proportion of the circumference of a circle vnto the Diameter thereof, which is *tripla ſeſquiſeptima*: that is to ſay the circumference is vnto the Diameter, as 22. is vnto 7.

The ſecond is the greateſt circuit of the earth in any meaſure, which was ſet downe in the 14. Chapter.

The fourth nnmber of the proportion being vnknowen, is the Diameter, which is ſought, firſt by multiplying the thirde by the ſecond, which is 7. & diuiding the product by the firſt, which is 22. then by ſubducting the 22. parte (which commeth forth of the diuiſion of the circumference by 22.) out of the circumference, & diuiding the remainder by 3. whereupon ariſeth the content of the Diameter, after *Ptolemee* conteining

teining miles $7159\frac{1}{11}$. furl. $57272\frac{8}{11}$. passi. $7159090\frac{10}{11}$. greater leag. $1718\frac{2}{11}$. After *Eratosth.* miles $19488\frac{7}{11}$ fur. $80181\frac{9}{11}$. passi. $19488636\frac{4}{11}$. greater leag, $2505\frac{13}{22}$.

The Semidiameter is the distance between the conuex surface of the earth, and the centre therof (which some do imagine to bee the place of hell) the said distance is found two waies.

1 By the proportion of the circle vnto the Semidiameter, which is *sextuple* ouer and beside $\frac{1}{14}$: or as 44. is vnto 7.

2 By diuiding the Diameter into two parts: by which meanes it shall bee found to conteine after *Ptolemee*, miles $3579\frac{1}{2}$. furl 28636. passes, 3579545. greater leag. $859\frac{1}{11}$. After *Eratosthenes*, miles 9744. furl $40090\frac{1}{2}$. passi. 974431. greater leag. $12\frac{1}{2}$.

The Area or plane is founde by multiplying halfe the circuit of the earth taken in anye knowen measure, by the Semidiameter thereof.

The conuex surface that couereth the whole earth, is founde by multiplying the terrestriall Area or plane, by 4.

The generall definition and diuision of the circles. Chap. 16.

IN as much as the surface of the Heauens is spherical, and their motion circulare, therfore for the better conceiuing of the reasons of the celestial motiõs, they are distinguished into certaine circles as partes, whereof we are to shew the names & the diuision.

In

In the names we are to conſider their acception, and their diuerſity, being notwithſtanding all one in ſignification.

The acception of the name Circle, is of two ſortes, Geometricall, and Aſtronomicall.

The Geometricall acception, is when a circle is taken for a plane figure, which one line equally diſtant from the centre doth encompaſſe.

The Aſtronomicall acception is ether as it ſignifieth a circular line, or a circumference wanting breadth: or elſe a circulare ſurface, which hath breadth therunto adioyned.

The diuerſitie of names all one in meaning, is when circles are called (amongeſt diuers Authors) threds, compaſſes, orbs, ſegments, rings, paralleles & equidiſtant lines.

The diuiſion of circles is diuerſlye deliuered by the Greekes and Latines, in three reſpectes.

Firſt in reſpect of the materiall ſphere, within the which ſome of the circles are not placed, & are therefore called extrinſecal, fixed, and manifold, as the Horizons and the Meridians: others are placed within the ſphere, & are therfore called intrinſecall, moueable, and ſingular, as are the two polares, the Equator, the zodiak, the two colures, and the two tropickes.

Secondly, in reſpect of the poles of the world, or the twofolde motion of the heauen: and in this caſe the Greekes diſtinguiſh them againe into three ſortes.

The firſt are paralleles, in number 5. namely the 2. polares, the 2. tropicks, and the Equator, all which haue the ſame poles with the world,

are equidiſtant on all ſides, and ſerue the fyrſt or vniuerſall motion.

The ſecond are oblique circles, in number 3. namely the Zodiak ſeruing the ſecond motion, the Horizon, the milke way, all the which lye oblique betweene the poles.

The thirde are thoſe circles that are drawen through the poles, and they are alſo 3. in number, namely the Equinoctiall and ſolſtitiall colure, and the Meridian

The thirde diuiſion of circles is in reſpecte of their quantity, according whereunto ſome circles are called greater, and ſome leſſe.

The greater circles are in number 6. namelye the Equator, the Zodiak, the 2. Colures the Horizon and the Meridian, all which are equall one vnto another, and cut the ſphere into equall pieces.

The leſſe circles are in number 4. namely the 2. polares, and the 2. tropicks, which are not all of them equall one vnto another, neither diuide they the ſphere into two equall pieces.

Of the greateſt circle conteining the meaſure of the firſt motion. Chap. 17.

THe whole heauen or vniuerſall frame, turned round by the firſt motion, doth in the middle place betweene the 2. poles, deſcribe a certain circulare compaſſe, whereof we are to conſider the name, the definition, the commoditye.

The name thereof is diuers: for it is ſometimes called

called ἰσημερινὸς, *Aequidialis*, that is, if we may ſo tearme it, equidiall, ſometimes the line or the orbe of the equalitye or equation of the day: ſometimes the Equinoctiall and Equator: and ſometimes the girdle of the firſt motion or moueable.

The definition thereof is that, wherein the magnitude, ſituation, and equall conuerſion thereof are conteined.

The magnitude thereof is conſidered, in that it is the greateſt circle, & hath theſe 2. proprieties, the one, that it diuideth the ſphere into 2. equall partes, the other, that it hath the ſame centre with the world.

The ſituation thereof is in the midſt between both the poles of the world, in which reſpect it differeth from the reſt of the paralleles, and oblique circles.

The equall conuerſion thereof, is that perfect reuolution which it fulfilleth within the determinate ſpace of 24. howers.

The commodity thereof is great & manifold, and it is either Aſtronomicall, or Geographicall.

The vſe therof in Aſtronomical matters, is ſeen chiefly in 4. thinges.

Firſt, by the helpe thereof we vnderſtand the meaſure of the firſt motion, and thereby recon the time, which is the meaſure of the firſt motió.

Secondly, it helpeth vs in the finding out of the Equinoctialls, and that in two reſpects.

The one, in reſpect of the whole Earth. For euery Horizon of euery countrey diuideth the Equator onely of all the paralleles, into 2. equall

pieces, whereby it commeth to paſſe, that when the ☉ is in the Equinoctiall, the day & the night throughout the whole world are equall.

The other in reſpect of certaine Regions. For thoſe that dwell vnder the Equator, in what part of the heauen ſoeuer the ☉ is, haue alwaies the *Aequinoctium*, or the day and the night equall.

Thirdly, thereby we find out both the ſituatiō of the Stars either toward the North, or toward the South, becauſe it diſtinguiſheth the North part of the world from the South: as alſo their declination, either Septentrionall or Meridionall.

Fourthlye, throughe the helpe thereof, wee ſearch the length of the artificiall day.

The vtility therof in Geographie is ſeene in 3. thinges.

1 Thereby we ſet euery town in his due place, in the terreſtrial Globe.

2 It bringeth vs vnto the knowledge of all the paralleles, aſwell celeſtiall as terreſtriall.

3 By the ayd thereof we finiſh the deſcription of the earth.

Of the greateſt circle meaſuring the ſecond motion. Chap. 18.

THe ſtarres of heauen which are mooued round about from the Weſt towarde the Eaſt, doe deſcribe in the midſt betweene their poles, a certen circulare ſurface common to all the planets, and a certen circulare line propre vnto the ☉ onely.

Con-

Concerning the circulare ſurface, there are deliuered by the Aſtronomers to be conſidered, the names, the definition, the meaſure, and the vſe thereof.

The names are diuerſe, drawen either from the Greekes, or from the Latines.

The Greekes call it the Zodiake, either of ζωη, lyfe, for that it is the path wherein the ☉, (taken to bee the author of life) doth walke: or elſe of ζῴδιον, a liuing creature, for that the ancient Aſtronomers, haue beautifyed this circle with the figures of certaine liuing creatures.

The Latines tearme it *Signifer*, as carrying the ſignes, they call it alſo the oblique circle, or the circle leaning a ſide.

The definition conteineth the magnitude, the oblique ſituation, and the limites thereof.

Concerning the magnitude therof, this is only to be conſidered: that it is one of the greater circles.

The oblique ſituation thereof, is either in reſpect of the paralleles, which it cutteth at inequal angles: or of the irregulare aſcenſions, and deſcenſions, or of the poles of the world, from the which it is not equidiſtant.

The limites thereof are the 2 tropicks, which it toucheth, and diuideth the Equator into two equall partes, declining therefrom by little & little vnto the diſtance of 31. gr. 28. mi.

The meaſure thereof is either in regard of the length that it hath, or of the breadth.

The length thereof is 360. gr. and is diuided into 6. Northren ſignes, as ♈. ♉. ♊. ♋. ♌. ♍.

&

& into 6. Southren ſignes, as ♎.♏.♐.♑.♒.♓.

The breadth thereof is 16 gr. as wel in regard of the roming of the planets from the Ecliptick, and ſpecially of ♀. & ♂. as alſo in reſpect of the principall conſtellations, whereof the greater part declineth from the midſt of the zodiake.

The vſe is chiefly ſeene in the obliquitie thereof: for thereby it falleth out, that the partes of heauen, do with the more eaſe maintaine their courſe againſt the firſt and vniuerſall motion: as alſo that the ſtarres may ſometimes bee in the South, and ſomtimes in the North, for the greater benefite of the inhabitants of the earth.

The circular line propre vnto the ☉ onely, hath diuers names, with the definition & commodity peculiarly appertaining thereunto.

It is called the wheeling, the way, the courſe, the place of the ☉, the Eclipticke line, alſo the burnt line, and the diuiſion of the zodiak.

The definition thereof, is that whereby it is called a greater circle, diuiding the breadth of the zodiake into 2. equall partes.

The commoditie thereof is noted as well in deſignin; the Eclipſes of the ☉ & ☾, which neuer happen but when both of them are vnder or very neere the Ecliptick line; as alſo in diſtinguiſhing of the 4. quarters or ſeaſons of the yeare.

Of certaine termes whereby the ſtarres haue relation vnto the aforeſaid circles. Chap. 19.

THe whole number aſwel of the fixed ſtarres, as alſo of the planets, hath relation both to the

the Equator, and to the Zodiak.

They haue a twofold relation vnto the Equator, either in regard of the orbiculare longitude of the Equator, or of the laterall poſition, therof.

In the orbiculare longitude of the Equator we are to note the names, and the definition.

It is ſometimes called the longitude of a ſtar: and ſometimes the right aſcenſion.

It is defined: The arke of the Equator comprehended betweene the head of ♈, and the ſection of a great circle paſſing through the poles of the world and the true place of the ſtar.

The lateral poſition hath alſo name, definition, and diuiſion.

It is called the declination of a ſtarre.

It is defined to be: The arke of a great circle, paſſing through the poles of the world, and the true place of the ſtarre, the ſaide arke being intercepted betweene the Equator, and true place of the ſtarre.

It is diuided into the Septentrionall, and Meridionall declination.

The relation that the ſtarres haue vnto the Zodiake, is alſo two folde, either according to the Longitude of the Zodiake, or els according to the tranſuerſe diſtance towarde either of the Poles.

In the Longitude of the Zodiake we are to conſider the name, and the definition.

It is called Longitude: For that it is reconed longwaies on the circumference of the Eclipticke: it is alſo called the true motion of the Starre.

It is defined to be the Arke of the Zodiake, intercepted betweene the head of ♈, and the ſection of a great circle paſſing through the poles of the Zodiake, and the true place of the ſtarre.

In the tranſuerſe diſtance we are to note the name, the definition, and the diuiſion.

It is called Latitude, becauſe it is reconed according to the poſition that it hath from ſome one ſide of the Ecliptick.

It is defined to be the arke of a great circle, drawen through the poles of the Zodiake, and the true place of the ſtarre, the ſaid Arke being intercepted betweene the Zodiake, and the centre of the Starre.

It is diuided into the Septentrional Latitude, when the ſtarres are vnder the northerly ſignes: and into the Meridionall Latitude, when they are in the Southerly ſignes.

Of the proportion and ſupputation of the declination of euery point of the Eclipticke, or the regarde of the partes of the Zodiake, vnto the Equator. Chap. 20.

IN the declination of any point of the Eclipticke, 2. thinges are to be obſerued: the proportion, and the ſupputation.

In the proportion we may note alſo 2. things: For either they haue none obliquation, or els their obliquations are equall.

Thoſe that haue none obliquation, are the head of ♈ and ♎, as being the common interſections of the Equator and the Zodiake.

It is

Thoſe that haue equall obliquations, are ſuch as are equally diſtant from the Equator, and they are either greater obliquations, or els the greateſt.

The greater obliquations are thoſe that haue any diſtance leſſe then the greateſt from either of the ſections, and of that ſorte there are alwaies foure.

The greateſt obliquations are thoſe that haue the greateſt diſtance from the Equator, as the head of ♋, that s, the Somer ſolſtice: and the head of ♑, that is the winter ſolſtice.

The ſupputation is made either by the tables of declinations, or of Sines.

The Tables of declinations are calculated in ſundrye places by Aſtronomers, and they conſiſt of the 2. ſides, the Area, and of the two extremities or endes.

The ſides are either at the right hand, or at the left: that at the left hand, to be entred into, whé you haue the ſigne in the toppe of the table: and that on the right hand, when the ſigne is in the foote therof.

The Area is that, wherein at the common angle the declination is found.

The 2. extremities are thoſe that conteine the ſignes: of which extremities, the one is called the toppe, or vpper parte: the other the foot, or the nether patte of the table.

The ſupputation that is made by the table of Sines, is performed by the helpe of the rule of 4. proportionall numbers, wherein 3. numbers are giuen, and fourth is to be ſought out.

The 3. numbers giuen, muſt conteine the right ſine of the whole quadrant, or of the ſemidiameter: the right ſine of the greateſt declination of the ☉: and the right ſine of the diſtance of the point of the Eclipticke giuen, from the firſt ſection of the Zodiake and the Equator.

The fourth number produced by multiplication and diuiſion, is the right ſine of the declination ſought, whoſe ſubtended arke declareth the number of degrees.

Of the 2. circles called the colures, diſtinguiſhing the Equinoctiall and Solſtitiall pointes. Chap. 21.

FOraſmuch as there are certaine pointes of the Zodiake and the Equator more notable then the reſt, therfore the Aſtronomers haue thought good to fit vnto thoſe pointes 2. Circles, wherof we may conſider the reaſon of their name, their definition, their number, their figuration or deſcription, and their vſe.

They are termed colures, that is imperfect, in 3. reſpectes.

1. Becauſe they appeare alwaies incomplete, or maymed, the which thing notwithſtanding ſemeth to be common with diuers other circles.

2. Becauſe they haue ſome partes that do neuer ariſe.

3. Becauſe they are carried about after an imperfect manner, & not according to the poſition of Longitude, as the motion of the Heauen is.

The definition conteineth their magnitude, their

their interſection, and their motion.

As touching their magnitude, they are of the number of the greater circles.

As touching their interſection, they cut one another in both the poles of the world, at ſpherical right angles.

In their motion, they are moued together with the ſphere.

Their number is two: wherof the one paſſeth through the Equinoctiall pointes and the poles of the world, and is called either the equinoctial colure, or the diſtinguiſher of the Equinoctialls: the other paſſeth through the ſolſtitiall pointes, and the poles both of Eclipticke and of the worlde: and is called both the ſolſtitiall colure, the diſtinguiſher of the Solſtices, and alſo the circle of the greateſt declinations.

Their figuration is deſcribed by the ſemidiameter of the worlde, whoſe reuolution being fullye perfourmed through the poles of the worlde and the Equinoctiall pointes, maketh the Equinoctiall colure, but paſsing through the poles of the worlde, and the ſolſtitial points, it maketh the ſolſtitiall colure.

Their vſe is manifolde, but principallye in 3. thinges.

1. In diſtinguiſhing ihe Equinoctiall and Solſtitiall pointes.

2. In reconing aſwell the quantitie of the greateſt declinations of the ☉, by the arke intercepted betweene the Equator and the Eclipticke: as the ſpace comprehended between the poles of the worlde, and the poles of the Eclip-

tick, which is alwaies equall vnto the arke of the greateſt declination.

3. For better vnderſtanding of the aſcenſions and deſcenſions of the ſignes.

Of the Meridian. Chap. 22.

THe ⊙ carried about by the firſt motion, whē it is at the higheſt, deſigneth a point of a circle, whoſe definition, varietie, and office, we are to conſider.

The definition taketh holde both of the names thereof, and of the matter it ſelfe.

It is called the circle Meridian, Meridionall, and Merinoctiall, the circle of the midday and midnight, either becauſe it diuideth both the day and the night into 2. equall partes, the one aſcending, the other deſcending: or els, becauſe ſo often as the ⊙, according to the firſt motion, is vnder the Meridian, it is then either midday, or els midnight.

The matter it ſelfe is that, according whereto it is defined to be one of the greater circles, drawen through the poles of the worlde, and the verticall point of any place geuen, and ſtanding ſtill when the Sphere is moued.

The varietie of the Meridian, by reaſon of the round figure of the earth, is either none at all, or manifolde.

It is none at all, either in regarde of reaſon, or of ſenſe.

It is none at all in regarde of reaſon, when one place is diſtant from another in Latitude onely,

that

that is, from the North to the South, or contrariwiſe.

It is none at all in ſenſe, when one place is diſtant from another according vnto Longitude, which is from the Eaſt vnto the Weſt, or contrariwiſe 36. ſcrup. that is, about 300. furlongs.

The varietie is manifolde in regarde alſo of reaſon and of ſenſe.

The manifolde varietie in regarde of reaſon is, when examining the leaſt diſtance towarde the Eaſt or Weſt, we conclude another Meridian: and by this meanes we may haue ſo many meridians, as there ſhalbe places at euery ſmall diſtance toward the Eaſt.

The manifolde varietie according vnto ſenſe, is as often as any two places ſhalbe diſtant one from another, betweene Eaſt and Weſt, more thé halfe a degree, and by this meanes we may haue ſo many meridians. as there are halfe degrees of the Equinoctiall circle.

The office of the Meridiane is twofolde, either Aſtronomicall, or Geographicall.

The Aſtronomicall office thereof is executed two manner of waies.

1. In pointing out the Noones tide, or Midday, either naturall or artificiall.

2. The diuers habitudes and poſitions of the ſtarres, following the motion of tbe heauen it ſelfe, are aſcribed vnto the Meridian.

The Geographicall office therof is alſo of two ſortes.

1. By the helpe thereof the Longitude of all places is calculated: and what places are more orientall,

orientall, and which more occidentall.

2. By the aide thereof we describe in the terrestriall plane, a correspondent merdiane line, for diuers vses of Astronomicalli Instrumentes.

Of the Horizon. Chap. 23.

THere is also another circle, which the ☉ by the firste motion dooth point out in the East and West pointes, whose definition, diuision, and dignitie, is to be considered.

The definition stretcheth it selfe both to the names therof, and to the matter.

It hath diuers appellations: and is sometimes called the Horizon, *Finitor*, *Finiens*, as limiting our sight, and sometimes the compasse or circle of the Hemisphere of diuers regions.

The matter it selfe attendeth the description of the centre or pole thereof, the circumference and the magnitude.

The centre or pole of the Horizon, is the verticall point of eache place, distant from the Equator so much, as the poles of the world are distant from the Horizon.

The circumference of the Horizon is that, which the semidiameter of the worlde in his full reuolution through the pointes of the East and West, and the rest of the brymme of Heauen, describeth.

The magnitude of the Horizon is considered, in that it is one of the greater circles, diuiding the worlde (in regarde of sense) into 2. equall segmentes, wherof the one is called the vpper,

the

the ſeene, or the diurnall ſegment, the other, the lower, the hidden, or the nocturnall ſegment.

The diuiſion of the Horizon is conſidered, in reſpect of the Equator as it is either a right, or an oblique Horizon.

The right, or orthogonall Horrizon hath 3. proprieties.

1 With the Equator it hath equal angles.

2 It hath the pole, or the verticall point in the Equator.

3 It hath the poles of the world in his circumference.

The oblique, bending, or inclining Horizon, is in all thinges contrary vnto the right.

The dignitie of the Horizon, by reaſon of the manifold vſe thereof, is great: For by the helpe thereof, we learne 6. thinges.

1 The quantityes of the artificiall daye and night, and conſequently the time of the riſing, and ſetting of the ☉.

2 The equall hower of the day, the ☉ ſhining

3 The degree of the Zodiak, wherewith anie ſtarre geuen doth ariſe and ſette.

4 What ſtarres do alwayes appeare, or are alwaies hidden.

5 The riſing and ſetting of the ſtarres.

6 The Eclipſes of the ☉ & ☾, either ſeene, or not ſeene.

The diuiſion of the Horizon, according to Proclus. Chap. 24.

MOreouer, the Greekes deliuer vnto vs a more ſubtile diuiſion of the Horizon: and it is twofold, the one to bee conceaued in

in mind, only, the other falling within the compaſſe of our ſenſe, or our ſight.

Concerning the Horizon to be conceaued in minde onely, wee are to note the names, the deſcription, the cauſe.

It is diuerſly named, as either rational, or conceaued by reaſon, by the Greekes called ἐπιβλητικὸς, and alſo naturall.

The deſcription thereof is abſolued by a ſemidiameter, and a circumference and the Area thereof.

The ſemidiameter is that line, whereof the one extremity is in the eies of the inhabitants of the world, the other exttemity is in the orbe of the fixed ſtarres.

The circumference and the Area is the ſpace and compaſſe, which the ſemidiameter maketh, beinge carryed about by the brimme of that part of the heauen, that is extāt aboue the Horizon.

The cauſe alleaged is, that our ſight beinge inhable to pearce vnto the beholdiug of all the fixed ſtarres, doth concludethat there is a certen circle in the heauen, that limiteth the thinges ſeene, from the thinges not ſeene.

In the Horrizon apprehended by our ſenſe, we are to note the names, the deſcription, the varietie.

It is called the Horizon ſenſible, or perceiued by our ſenſe, alſo the apparent, and artificiall Horizon.

The deſcription is perfourmed by a ſemidiameter

meter, a circumference, and a plane.

The ſemidiameter is that line, whereof the one limite is in our eye, the other is in the end of our ſight vpon the ſurface of the earth, conſiſting of a thouſand furlongs, which ende wee imagine in a free proſpect, to ioyne the heauen and the earth together.

The circumference and plane is that ſpace & compaſſe, which the aforeſaid ſemidiameter turning about, doth deſcribe.

The variety is common aſwel vnto the Rationall, as the ſenſible Horizon, & it is either none at all, or elſe manifold.

The variety of the ſenſible Horizon is ſaid to bee none at all, when the Horizon doth continue all one and the ſame, and it is ether in reaſon, or in ſenſe.

The ſenſible Horizon is not varied in reaſon, when the places are not any whit, nor any way changed.

The ſenſible Horizon is ſaid not to be varied in ſenſe, when the places diſtant about 400. furlonges one from another (that is 48. mi.) do not alter, either the climate, or the length of the dayes, or the apparences of the heauens.

The variety of the ſenſible Horizon is manifold, when the places are varied more then 400. furlonges, and are ſituated either towarde the Eaſt, or Weſt: in which variety neither the climate, nor the length of the day, nor the apparences of the heauens are changed with the Horizon: or elſe they are ſituated toward the north or ſouth, wherin together with the Horizō

both the climate, and the length of the dayes, & the apparences of the Heauens are altered.

Of the two Tropickes. Chap. 25.

THe ☉ carryed about by the second motion, in his greatest declination from the Equator by the violence of the first motion, describeth certaine paralleles, whereof the generall reason, the number, & the offices are to be considered.

The generall reason is ether in respect of their names, or their definition.

They are named by the Greekes τροπικοί, Tropickes, by the Latines *Versiles, conuersiui, Vertentes,* tourning, and the Solstitiall paralleles.

Their definition conteineth their quantitie and their circumference.

Their quãtity is noted, either in respect of the other circles, these being compted in the number of the lesse circles, or in regard of thẽselues, whereby they are compted equall, in asmuch as they are equally distant from the centre of the world, beeing separated the one from the other by the double distance of the ☉ greatest declination.

Their circumference is that round compasse, which the ☉, passing throughe the 2. solstitiall points, doth describe.

They are in number 2. the one Septentrionall, the other Meridionall.

The Septentrionall Tropicke is on this side of the Equator (in respect of vs) which wee call either the Sommer tropicke, for that it passeth through

through the poinct of the Sommer ſolſtice, or els the tropick of ♋, becauſe it is deſcribed through the end of ♊, & the beginning of ♋.

The Meridionall tropicke is ſituated on the other ſide of the Equator, and is called either the Winter tropicke, as paſſing through the poinct of the Winter ſolſtice, or the tropicke of ♑, becauſe it is drawen through the head of ♑.

The offices and commodities of them, are in number 4.

1 They ſhewe the Tropes, that is, the conuerſions, or tournings of the ☉, aſwel in Sommer, happening in our age the 3. and 2. of the Ides of Iune, as alſo in winter, the 3. & 2. of the Ides of December.

2 They ſhew in euery ſituation of the ſphere, both the longeſt day, which is as long as the diurnall Arke of the Tropicke of ♋, conteineth howers: and the ſhorteſt day, which is as long as the ſpace of howers, conteined within the diurnall arke of the tropicke of ♑.

3 They poinct out the limits of the courſe of the ☉, and his greateſt declinations: which are 23. gr. 52. mi. as in the time of *Ariſtarchus* & *Ptolemee*, or 23. gr. 28. mi. as it is now in our time.

4 They ſhew the burnt zone which they ſeparate from the temperate, and the midſt of the ſecond climate, which they call *dia-Syenes*, and *Anti-dia-Syenes*.

Of the 2. polare circles. Chap. 26.

The two poles of the Zodiake, carried about by the regulare reuolution of the vniuerſall

frame, deſcribe about the poles of the worlde, two circles, whereof the generall reaſon, the number, and the vſe is to be noted.

The generall reaſon offereth to our conſideration, their name, their definition, and their accidents.

They are called the Polare circles, either becauſe they are deſcribed about the poles, or by the poles.

Their definition by the Latines, is made by their quantitie, and their circumference and plane.

Touching their quantity, they are in the number of the leſſe circles, equall in all places.

Their circumference and plane is deſcribed either by lines, drawen from the poles of the Zodiake, vnto the Axe of the worlde, at right angles, and hauing by the daily motion a perfect reuolution: or els they are deſcribed by certen ſemidiameters, drawen from the centre of the earth vnto the poles of the Zodiak, and turned about by the diurnall and nocturnall motion.

The accidentes of the polare circles do determine either their equality, for they are paralleles, compared either one with another, in aſmuch as they are equidiſtant from the centre, or compared with the tropicks, & the Equator: or elſe they determine their diſtance, either from the next tropicke, which is 43. gr. or from the poles of the worlde, which is equall vnto the ☉ greateſt declination.

They are two in number: The one Septentrionall

nall, the other Meridionall.

The Septentrionall Polare circle is deſcribed by the North pole of the Eclipticke: the Meridionall, by the South pole thereof.

The Septentrionall polare circle is called Boreall, North of the North winde called *Boreas*, and Arcticke, and Septentrionall, becauſe of the 2. conſtellations, the one of the greater beare called *Arctos*, the other of the leſſe beare called *Septentriones*, which are nigh thereunto.

The Meridional polare circle is called *Auſtrall*, or Southerne of the South winde called *Auſter*, and Antarcticke, as oppoſite vnto the Arcticke, and Meridionall, of the South part of heauen, called *Meridies*.

Their vſe is noted in that they comprehende the cold and frozen zones, and the inhabitants of the earth called *Periſcii*, whoſe ſhadowes goe round about them, and on either ſide limite the the diſtances of the poles.

The Polare circles otherwiſe deſcribed according to the Grecians. Chap. 27.

THe polare circles are deſcribed, either according to the greateſt declination of the ☉ or the altitude of the Pole aboue the Horizon.

The greateſt declination of the ☉, by means of the motion of inclination of the eight Sphere, is diuerſe. For it was one in times paſt, and is found to be another now: and of ſuch circles, the reaſon is declared in the Chapter before.

The polare circles deſcribed according to the altitude of the pole, require the conſideration

of

of their definition, their varietie, their offices, and the manner of their deſcription.

In defining the Arcticke polare circle, we ſay: 1. That it is the greateſt of thoſe circles which are alwaies in our ſight, that is, of thoſe which we may ſee at the ſame inſtant: 2. that it toucheth the Horizon in one point: 3. that it is altogether aboue the earth.

In defining the Antarctick polare circle, we ſay: 1. that it is equall and parallele vnto the Arcticke: 2. that it toucheth the Horizon in one point: 3. that it is altogether hidden vnder the earth.

The varietie is manifolde, according to the diuerſitie of the climates. For either they are not at àll, as in a right Sphere it happeneth, where excluding altogether the polare circles, the Grekes recon 3. paralleles onlie: or els they are, and thoſe ſometimes either leſſe, equall, or greater then the tropickes, or els they are equal vnto the Equator and the Horizon. For by how much the pole ſhalbe higher, by ſo much ſhal theſe circles be greater.

The offices and vſe of the Arcticke circle is, in that it ſheweth the Starres that neuer ariſe nor ſette: of the Antarcticke circle, the contrary is to be conceiued.

The meanes of their deſcription is by thoſe Starres, that in any Region do touch the Horizon.

Of the Milkie circle. Chap. 28.

OF all the circles, there is none to be ſeene, beſide the Milkie circle, which for that the

Greekes

Greekes do recon among the other circles, we wil expreſſe the names, the definition, the cauſes thereof, and the diſtinct Starres which make the ſame.

The names are diuerſe: as *Galaxia*, the Milkie orbe or circle, the Milkie Zone or milkie waye. The Arabians cal it *Mataratí*, as it were a broad, ſpace, or arke that moueth.

It is defined to be one of the greater circles, oblique, drawen or ſtretched toward both the Poles, moſt brightly ſhining, apparent vnto the ſenſe, inequall, both in breadth and in colour.

The cauſes are diuers, and thoſe either fabulous, or naturall.

The fabulous cauſes are in number 4.

The firſt is taken from the ſcorching of the ☉, as if the ☉ had ſometimes made his motion there, and by his ſcorching had cauſed that place to be white.

The ſecond is drawen from the milke of *Iuno*, that running plentifully out of her pappes, painted this circle of that colour.

The third is fetched from the ſeate and habitation of ſtrong and valiant men, whom the Poets haue placed in this circle.

The fourth is deriued out of the way of the Gods, as if they paſſed thereby vnto the pallace of *Iupiter*.

The naturall cauſes alleadged (although they be many, yet) are principally, but 3.

The firſt by *Theophraſtus*: who ſaid, that it is that ioyning together, wherby the heauen being diuided into two hemiſpheres, is as it were by a certen

certen claye faſtened.

The ſecond, by *Ariſtotle*: who tooke it to be a Meteore, ſet on fire in ſuch ſorte as a Comete,

The third is Aſtronomicall: which affirmeth that it is a girdle cauſed by many little ſtarres, as it were one touching another, in the which concurring in th at Place, the light of the Sunne is diffuſed.

The diſtinct ſtarres that make it, are cheiflie theſe: The *Arowe*: the *Eagle*: the bowe of ♐: the *Altare*: the 4. feete of the *Centaure*: the ſhip *Argo*: the head of the *Dogge*: the right hand of *Orion*: *Erichthonius* or the *Wagoner*, with the *Goate* on his ſhoulder: *Perſeus*: *Caſſiopeia*: and the *Swanne*.

Of the 5. principall Regions of the worlde, commonly called Zones. Chap. 29.

THe Vniuerſall Globe aſwell of the heauens, as of the earth anſwerable thereunto, is diſtinguiſhed into certain orbicular tractes, which the ſpaces comprehended betweene the 4. paralleles do make, of which tractes we may conſider the names, the definition, the generall nũber, and their diſtance one from another.

Their names are diuerſe: For they are called either Zones, or ſwadlingbandes, or girdles, or *Maſhes*, or coaſtes.

They are defined to be the ſpace either of the heauen, or of the earth, comprehéded between two leſſe paralleles, or els included on euerye ſide with the polare circles.

Their

Their generall number is twofolde: For either they are celeſtiall, and ſo the cauſes of the terreſtriall, or els they are terreſtriall, of the ſame proportion with the celeſtiall.

The celeſtiall are either Meane, or Extreme, or betweene meane and extreme.

The Meane is that Zone which is included betweene the 2. tropickes, and is cut in two equall partes by the Equator.

The Extremes or polare Zones, are thoſe whereof (being but 2) the one is called the Septentrionall Zone, within the Arcticke circle: the other the Meridionall Zone, within the Antarcticke circle.

The Zones betweene meane and extreme, are alſo 2. whereof the one is Septentrionall, comprehended betweene the tropicke of ♋, and the circle Arcticke, and the other Meridionall comprehended betwene the tropicke of ♑, and the circle Antarticke.

The terreſtriall Zones haue the ſame reaſon with the celeſtiall, aſwell in reſpect of their nũber, as in regarde of their names.

The terreſtriall Zones are alſo 5. in number, anſwering proportionallye vnto thé 5. celeſtiall Zones, conically marked out by the 4. celeſtiall paralleles.

The terreſtriall Zones haue the ſame reaſon with the celeſtiall, in reſpect of their names alſo: For that terreſtriall Zone that is vnder the mean celeſtiall, is called meane: thoſe which are vnder the extremes or polares, are called extremes ſeptentrionall, or Meridionall: and thoſe which

are vnder the Zones betweene meane and extreme, haue their name accordingly, and are either Northerlie, or Southerlie.

The distance one from another is in this manner: the meane or burnt Zone, according to the Latitude reconed in the Meridian, conteineth 47. gr. or 705. miles: the extreme intemperate Zones do each of them, according to the said reconing conteine, as many degrees and miles, as the meane: the temperate zones betweene meane and extreme, do eache of them conteine according to the former reconing 41. gr, or 645. miles.

The difference of the Zones, and the manner how all places vpon the earth, may be brought within their compasse. Chap. 30.

THe difference also of the zones aswell celestiall as terrestriall, and the reason how all places vpon earth may be referred vnto them, is worthie the noting.

Their difference is to be considered either in respect of their figure, or their accidental nature.

The figure of the meane is vniforme, and for the most parte alike.

The figures of the extremes are either of the equall to other, yet such, as that they seeme rather to carie the shape of circles, then of zones.

The figures of the zones betweene meane and extreme, be either of them alike, and equall vnto the other: yet about the tropicks their figure is limited with a greater compasse, then towarde the

the polare circles.

The accidentall nature of the zones is that, in regarde wherof they are ſaide to be meane, extreme, and betweene meane and extreme.

The Meane or burnt zone is diuided into 2. partes, whereof the one is ſituated vnder the Equator, the other about the Tropickes.

That parte which is ſituated vnder the Equator ſeemeth to be temperate, and that for three cauſes.

1. By reaſon of the ſodaine and croſſe acceſſe, and receſſe of the Sunne.

2. By reaſon of the continuall equality of the night and day in that place.

3. By reaſon of the ſwift carying about of the ☉, by the firſt motion.

That parte which is ſituated vnder the Tropickes is hardlye to be inhabited, and that alſo for 3. cauſes.

1. For the ſlowe conuerſion of the ☉.

2. For the doubled proiection of the Sunne-beames, vpon thoſe places.

3. For the great increaſe of the Sommer daies aboue the nights.

The extreme zones are both of them frozen, by reaſon of the too much colde that falleth out there, by meanes of the oblique proiection, and reflexion of the Sunne beames.

The zones betweene meane and extreme are both of them temperate, and are diuided into 3. Regions, whereof one is ſituated about the middle parte thereof, which we iudge ſimplie to be temperate, by reaſon of the moderate heate

of the ☉, namely, from 34. gr. vnto 48. gr. diſtance from the Equator: the other 2. regions are about the extremes therof, the one being about the tropicks, and ſo ſubiect vnto the intemperate heate of the burnt zone, the other nigh vnto the polares, and therfore ſubiect vnto the intemperate colde of the frozen zone.

The reaſon how al places vpon the earth may be referred vnto thoſe zones, hath two conſiderations.

1. If the places haue Septentrionall Latitude, and that leſſe then the greateſt declination of the ☉, they belong vnto the burnt zone: if equall, vnto the trop. of ♋: if greater, and yet not exceeding 60. gr. 30. mi. they belong vnto the temperate zone. If the ſaid ſeptentrionali Latitude be equall vnto the complemēt of the greateſt obliquation, they muſt be placed vnder the arctick circle: if greater, vnder the frozen zone.

2. If the places giuen haue Meridionall Latitude, the ſame Iudgement is to be pronounced of them, as of the places vnder Septentrionall Latitude.

Of the fowerfolde riſing and ſetting of the Starres. Chap. 31.

THe Poets, and for the better parte all other Authors, doe periphraſticallye deſcribe the times of th inges, worthie the noting, by the Starres of heauen, either riſing or ſetting.

In their riſing is to be conſidered, the definition, the ſubdiuiſion.

The definition doth cheiflie conſiſt of the name,

name, and of the matter.

The name in this place ſignifieth their firſt apparition vnto the eie, or their Aſcenſion.

The matter is that according wherunto, the riſing of a ſtarre is defined to be the apparition of any ſtarre giuen, which before could not be be ſeene, as either being vnder the Horizon, or hidden by the Sunne beames.

The ſubdiuiſion alſo offreth 2. conſiderations.

1. That the ſtarres do aſcend or riſe by the vniuerſall motion from the lower hemiſphere vnto the Horizon, either in the morning with the ☉, and then they are ſaid to haue a morning, a diurnall, a coſmicall, or worldly riſing: os els in the Euening at the ☉ ſetting, and then they are ſaide to haue an euening, a nocturnal, a chronicall, or acronychall riſing.

2. That the ſtarres do riſe by the 2. motion freed from the ☉ beames, either before the riſing of the Sunne, and then they are ſaide to haue an Heliacall morning riſing, which commeth to paſſe in thoſe ſtarres that are ſlower then the ☉, or els after the ſetting of the ☉, and then they are ſaide to haue an Heliacall euening riſing, and that is in thoſe ſtarres, that are ſwifterthé the ☉.

In the ſetting of the ſtarres there is alſo offred the definition, and the ſubdiuiſion.

The ſetting is defined to be: the occultation or hiding of any ſtarre giuen, either by the depreſſion therof vnder the Horizon, or by the ingreſſion thereof into the beames of the ☉.

The ſubdiuiſion conſiſteth in their ſetting and withdrawing from our ſight, which is done two

manner

manner of waies.

1. By the first motion they descende from the vpper hemisphere vnto the lower, either in the morning which is done cosmically at the rising of the Sunne, and that setting, as the rising also, is referred vnto the ☉, and those signes of the Zodiake which the ☉ possesseth: or els in the euening, which is done chronically, at the setting of the ☉, and this setting, as also the rising, is referred vnto all the starres generally.

2. By their propre motion at their entrance into the beames of the Sunne, either before the sunne rising, that is, cosmicallye, which happeneth onely vnto the starres that are swifter then the ☉, or els after the setting of the Sunne, that is, chronically, which belongeth vnto those starres onlie, that are slower then the ☉.

Another more easie and perfect distinction of the risinges and settinges, with the exposition of certen principles which are to be Vnderstoode for the reading of Authors, concerning the rising and setting of the Starres, taken out of Ptolemee, *and the later Astronomers.* Chap. 32.

FOr the easier vnderstanding of the Poets and other Authors, which by the rising and setting of the starres do circumscribe the times, 4. things chieflie are to be knowne.

1. The latitude of the place wherof the speach is made, which may be gathered out of the Tables of the Regions, set downe in all Geographicall writings.

2. The

2. The place of the ☉ in the Eclipticke at any time, which the ancient Recordes do miniſter, where notwithſtanding you muſt note, that our age doth differ from former times: and that the ☉ in our age doth entre into the heades of the ſignes, ſooner almoſt by 6. daies, then in the ancient times.

3. What ſignes are oppoſite one vnto another: viz. ♈ to ♎: ♉ to ♏: ♊ to ♐: ♋ to ♑: ♌ to ♒: & ♍ to ♓.

4 The difference of the riſing, or of the ſetting.

The riſing is either Heliacall and of the Morning, or Acronychall and of the euening.

The Heliacall or morning riſing, is either true or apparent.

The true Heliacall riſing is when a ſtarre ioyned with the Sunne, doth together and at the ſame inſtant ariſe with him in the morning.

The apparent Heliacall riſing, is when the ſtar doth aſcende and begin to appeare at the dawning, and before the Sunne riſing.

The Acronychall or euening riſing, is alſo either true, or apparent.

The true Acronychall riſing, is when a ſtarre preciſely riſeth, at the very inſtant of the Sunne ſetting.

The apparent Acronychall riſing is when after the ſetting of the Sunne, the ſtarre being freed from the beames thereof, ſhall make his firſt apparence in the twilight.

The ſetting of a ſtarre is alſo either Heliacall, or Acrouychall.

The Heliacal ſetting is either true or apparét.

The

The true Heliacall setting is whē a star at the ☉ rising, doth at the same instant set in the opposite part of the world, which before was called the morning starre.

The apparent Heliacall setting is when in the morning, somewhat before the ☉ rising, the starre is newly seene to set.

The Acronychall setting is in like sorte either true or apparent.

The true Acronychall setting is when at the ☉ setting, the starre also setteth, which all the meane time was called the euening starre.

The apparent acronychall setting is when after the setting of the ☉, the starre doth not set at the same instant with the ☉, but by reason it is hidden by the beames of the ☉, it appeareth no more vntill the morning that it arise againe.

Of the Astronomicall rising & setting of the signes: or as the Greekes call it, Διαφία καὶ πραγματία τῶν ἀναφορῶν καὶ καταφορῶ. Chap. 33.

THe rising, the comming vnto the Meridian, and the setting of the signes, or of any point of the heauē, is either poetical, or astronomicall.

The Poeticall or vulgare, is when the reason of the apparition, or occultation of the signes, is onely in their comparison with the ☉, which was handled in the 31. & 32. chapters.

The Astronomicall rising, culmination, & setting of any starre or point of the heauen is that which defineth the proportion of the time and space, both when and how great it is, wherein the

the aforeſaid thinges are performed, either in a right, or an oblique ſphere.

In the riſing are to be conſidered the definition, and the bipartite diuiſion.

The definition is either of the name, or of the matter.

The aſcenſion is called the riſing, which wee meaſure by the coaſcendēt arke of the Equator.

The matter is that, according whereunto it is defined, to be the arke of the Equator, comprehended between the ſigne riſing, or the Eaſt part of the Horizon that conteineth the ſigne, & the head of ♈, the which arke is to be accōpted according to the orderly ſucceſſion of the ſignes.

The conſideration had of the diuiſion, is that either a greater portion of the Equator riſeth with the ſigne, & then it is ſaid to haue a right aſcenſion, becauſe it maketh righter angles with the Horizon: or els that a leſſe portion of the Equator doth aſcende therewith, and then it is ſaid to haue an oblique aſcenſion, by reaſon of the more oblique angles that it maketh with the Horizon.

The culmination is defined, either the paſſing of ſome poinct of the Zodiake, or of the world by the Meridian circle, or elſe the degrees of the Equator, which with the portion of the Zodiake geuen, paſſe through the Meridian.

The ſetting of a ſigne or of any poinct of the heauen, offereth 2. thinges vnto our conſideration, the definition, and the diuerſity thereof.

The definitiō is either according to the name, or according to the matter.

According to to the name, it is called the deſcenſion or ſetting, which wee meaſure by the arke of the Equator deſcending therewith.

According to the matter it is defined to bee the arke of the Equator, cõprehended between the ſigne or poinct ſetting, and the head of ♈.

The conſideration of the diuerſity of ſettinge, is either that a greater part of the Equator deſcendeth with the ſigne or poinct of the heauen, and then it is ſaid to haue a right, or a long, and ſlowe deſcenſion: or els that a leſſe portion of the Equator ſetterh therewith, and then it is ſaid to haue an oblique, or a ſhort and ſwift deſcenſion.

Of the diuerſitie of aſcenſions, deſcenſions, and culminations, in a right ſphere. Chap. 34.

THe Zodiake in a right ſphere is fitted vnto the equall conuerſion of the Equator, and together with the partes thereof, paſſeth by the Eaſt, or the Weſt, or the midſt of heauen, both in the quadrants or quarters, and in the ſignes.

The quadrants in equall ſpaces of time do aſcend and deſcend, or do paſſe through the midſt of heauen, beginninge either at the Solſtitiall poinctes, namely at the heade of ♋ & ♑, and compting to the end of ♍ & ♓: or els, beginning at the Equinoctiall poincts, which are the heads of ♈, & ♎, and compting to the ende of ♊ & ♐.

The ſignes applied vnto the motion of the Equinoctiall, are conſidered either whole, or in partes.

The ſignes conſidered wholly, haue relation either

either vnto the Equator, or vnto the Zodiake.

The ſignes in their relation vnto the Equator, do aſcend inequally: For ſome of them doe riſe rightly, and ſome obliquely.

Thoſe that haue right aſcenſion are ♊.69. ♐. ♑. with the which there do coaſcende 32. gr. 11. mi. of the Equator.

Thoſe that haue oblique aſcenſion, are ♈. ♎. ♓. ♍. wherewith there doe coaſcende 27. gr. 54. mi. of the Equator: and ♉. ♌ ♏. ♒. wherewith there ariſe 29. gr. 54. mi. thereof.

The ſignes in their relation vnto the Zodiake, or conſidered ſeuerally apart, haue aſcenſions, either equall or inequall one vnto another.

They haue equall aſcenſions, that come forth in equall times, and they are either oppoſite in the diameter, or equally diſtant from the Equinoctiall poinctes, as are ♓♈: ♒♉: ♑♊: ♐69: ♌♏: ♎♍.

They haue inequall aſcenſions that neither are oppoſite, nor equally diſtant from the aforeſaid poinctes.

The ſignes conſidered in their parts, haue alſo relation either vnto the Equator, or vnto the Zodiake.

The partes hauing relation vnto the Equator do (as before) aſcend inequally, and that either rightly or obliquely.

The partes hauing right aſcenſions, are comprehended within the foure ſignes, nexte vnto the 2. ſolſtitialles.

The partes hauing oblique aſcenſions, are conteined within the ſignes next vnto the Equi-

noctiall poincts on each side.

Those partes of the signes, that haue relation vnto the zodiake, haue their ascensions partly equall, and partly inequall.

Partes hauing equall ascensions are these: the first degree is equall vnto the first degree of the opposite signe: and the first degree vnto the last of another signe equidistant from the equinoctial poincts.

Partes hauing inequall ascensions, are those, in whom neither opposition falleth out, nor equidistancie.

Of the diuersity of ascensions, and descensions in an oblique sphere. Chap. 35.

IN the oblique situation of the sphere we consider either the proportion of the ascensions, or of the descensions of the zodiake.

The ascensions are compared and applyed either vnto the Equator, or one with another, or vnto the ascensions of a right sphere.

Beeing compared vnto the Equator, they are either equall, or inequall vnto the ascensions thereof.

In their equality they are numbred either in the Northren semicircle from the head of ♈, vnto the end of ♍: or from the head of ♎, vnto the end of ♓.

In their inequality, they are reconed either in the whole semicircles, beginning not in the Equinoctiall poinctes, but els where: or els the reconing is made, in some of their partes.

In

In their compariſon one with another, they are either equall, or inequall.

When they are equall, they are reconed in ſome 2. concordant arkes of the Ecliptick, as in ♈: 14. gr. 50. mi. ♉♒: 18. gr. 51. mi. ♊♑; 27 gr. 16. mi. ♋♐: 36. gr. 58. mi. ♌♏: 40. gr. 57. mi. ♍♎: 40. gr. 58. mi. in the latitude of 40. gr.

When they are inequall, they are reconed either in parts not equidiſtant, or in the ſemicircle either aſcendent, or deſcendent.

The ſemicircle aſcendent is from the head of ♑ vnto the end of ♊, and that aſcendeth more oblique and ſwift.

The deſcendent ſemicircle is from the head of ♋, vnto the end of ♐, & it aſcendeth more right and ſlow.

When the aſcenſions are compared vnto the aſcenſions in a right ſphere, they are either leſſe, or more oblique: or greater, or righter then the ſaid aſcenſions in a right ſphere.

The leſſe or more oblique fall out in the North ſemicircle: the greater or more right happeneth in the South ſemicircle: the diſtance betweene the aſcenſions of each ſphere, is called the difference of aſcenſions.

The deſcenſions of the Zodiake, are vnto the aſcenſions thereof either equal, or inequall.

They are equall either in regard of the moities of the Ecliptick comprehended betweene the equinoctiall poinctes, or elſe according to the equidiſtant, or oppoſite partes of the Zodiake.

The

The deſcenſions of the Zodiake are inequall, being compared either vnto the right ſphere, or vnto the ſame climate.

The deſcenſions of an oblique ſphere are more oblique, then the deſcenſions of a right ſphere whereunto they are compared, when as the aſcenſions in an oblique ſphere, are more right then in a right ſphere.

The deſcenſions of an oblique ſphere are more right then the deſcenſions of a right ſphere, when as the aſcenſions in an oblique ſphere, are more oblique then in a right ſphere.

The inequall deſcenſions of the zodiak, compared vnto the ſame climate are to bee noted, either in the parts of the Zodiake which deſcending oblique doe riſe right, ſuch as are the parts of the deſcending ſemicircle: or els in the parts of the zodiake, which deſcending right do riſe oblique, and ſuch are the partes of the aſcending ſemicircle.

Of the naturall day, and of the inequality and difference thereof. Chap. 36.

OVt of the premiſſes wee may, not vnfitly, deriue ſome matter concerninge the dayes, whereof there are two ſortes, the one is called ciuile or naturall, the other artificiall.

In the ciuile or naturall day, we may conſider the definition, the diſtinction, and the cauſe of inequality.

The definition reſpecteth either the name, or the thing it ſelfe.

It is called either naturall, as cauſed by the naturall

naturall, or regulare motion of the whole: or νυχθήμερος by *Ptolemee*, as conſiſting of the night and day together: or els ciuile, becauſe all nations naturally do tearm it a day.

The definition reſpecting the thing is that, according to which it is defined to be the ſpace of 24. howers and certen minutes, conſiſting of light and darkeneſſe.

The definition thereof is in reſpect of the continuance and length of the day, and thereof one is called inequall, or different, alſo the true and apparent day (the Greekes call it ἀνώμαλον, irregulare:) another the equall, or meane day.

The inequall or different daye, is the ſpace of 24. howers and ſo many minutes, as are anſwerable vnto each portion of the zodiak, which the ☉ doth daily run ouer.

The equall or indifferent day, is the ſpace of 24. howers and ſo many minutes, as are anſwerable vnto the quãtity of the meane motiõ of the ☉ in one day, which is 59. gr. 8. mi.

The cauſe of the inequality happeneth vntó the true naturall day, either in a right, or in an oblique ſphere.

The cauſe of the inequality happening in a right ſphere, is through the inequall augmentation, by meanes either of the Equinoctiall aſcenſions inequally anſwering the ſame, by reaſon of the obliquitie of the zodiak: orels of the motiõ of the ☉, which about the cẽtre of the world is inequal

The cauſe of the inqualitye of the day happening in an oblique ſphere, is through the inequall

quall augmentation apperteining either to the Equinoctiall ascensions inequally answeringe the same, by reason of the obliquity aswell of the Horizon, as of the zodiake: or else, to the eccentricke circle of the ☉ wherin the ☉ running doth in equall tymes, perform an inequall motion.

The Artificiall day is handled in the Chap. following.

Of the artificiall day and night, and the diuersitie belonging to them both. Chap. 37.

THe ☉ caried about by the first motion, distinguisheth the naturaall day into two partes, whereof the one is called the artificiall day, the other the artificiall night.

Concerning the artificial day, Astronomy deliuereth the definition, and the proportion thereof.

The definition conteineth the Author, and the terme thereof.

The Author of the artificiall day is the ☉, who caried about by the first motion, describeth in the day time a certen arke.

The terme is either from whence: that is, from the Easterlie part of the Horizon: or by what: that is, by the verticall meridian: or vnto what: that is, vnto the Westerly part of the Horizon.

The proportion of the artificiall day is deliuered in so much as apperteineth vnto the length thereof, either in a righte, or in an oblique sphere.

In a right sphere it is alwaies equall vnto it selfe,

ſelfe, and to the night, by reaſon of the equalitie both of the Aſcenſions (for the one halfe of the Equator doth alwaies equally aſcend, and deſcend with ſixe ſignes of the zodiake) and of the diurnall, and nocturnall ſegments.

In an oblique ſphere the dayes to themſelues and to the nights are either equall, or inequall.

The dayes are equall both to themſelues and to the nightes in the Equinoctiall, by reaſon of the equality both of the aſcenſions (for looke how great the aſcenſion of the diurnall arke is, ſo great alſo is the deſcenſiō of the nocturnal) & of the ſegments which the ⊙ deſcribeth, the ſaid ſegments being incident with the Equator.

The daies are inequal both among thēſelues, and to the nightes, when the ⊙ hath paſſed the Equinoctiall poincts, aſwell by reaſon of the diuerſity of the aſcenſions of the ſignes, as alſo by reaſon of the Sunnes inequall deſcribing of the paralleles by the motion of the world.

The artificiall night geueth vs to conſider the definition and the meaſure.

It is defined to be the part remaining of the naturall day, comprehending the ſpace between the ſetting of the ⊙, and the riſing thereof.

The meaſure thereof is either equall, or inequall.

The equality of meaſure falleth out in the right ſphere alwaies, in an oblique ſphere two times in the yeare.

The inequality of meaſure hath notwithſtāding either a like diuerſity in the ſignes equidiſtant frō the Equator: or alternate in oppoſite points.

Of the reaſon of the equall and inequall howers. Chap. 38.

HAuing thus ſet downe the deſcription of the dayes, it falleth out nowe, to intreat of their partes commonly called howers, whereof we muſt conſider the generall reaſon, and the diuiſion.

The generall reaſon attendeth their definition, their number, and their ſubdiuiſion.

They are defined to be that ſpace of time, wherin the 24. parte, or 15. gr. either of the Equator, or of the Eclipticke, do fullie ariſe.

They are in number 24, belonging vnto euery naturall daye.

Euery hower is ſubdiuided into 60. minutes, euery minute into 60. ſeconds, &c.

The diuiſion of the howers conſiſteth in this, that either they are reconed in the Eclipticke, or els in the Equator.

Thoſe that are taken in the Eclipticke, the aſcenſions whereof do varie, are called inequall howers, whereof the names, the definition, and the number are to be noted.

They are called naturall (by *Io. de ſacro boſco*) and temporall, and artificiall, and Planetarie.

They are defined to be the ſpace of time wherin the moitie of a ſigne of the Zodiake, counted from the place of the ☉, or the oppoſite thereof, doth aſcende.

Their number is as much by day, as by night: For 6. ſignes of the Ecl. do alwaies ariſe, alwell by

by day, as by night.

The howers that are reconed in the Equator, which ariſeth vniformelie, are called equall howers, whereof we are in like manner to note the names, the definition, and the number.

They are called naturall (by many) and equinoctiall howers.

They are defined to be that ſpace of time, wher in 15, gr. of the Equator do fully ariſe.

Their number is alwaies inequall, ſauing in the 2. Equinoctiall ſeaſons. For at other times, 6. ſignes of the Equator do not euerye daye completely ariſe and ſet.

Of the diuers accidents of diuers partes of the earth, according to the diuerſe ſituation of the Sphere. Chap. 39.

THe ſituation of euery place and region on the earth, is in the ſpace either of the burnt, or temperate, or frozen zone.

The places ſituated in the burnt zone, are either in the meane ſpaces, or betweene meane & extreme, or in the extremes.

Their ſituation that are in the meane ſpaces, differeth from the reſt: 1. In the 4. ſortes of ſhadowes which they haue, viz. Septentrionall, Meridionall, Orientall and Occidentall: 2. In their 4. ſolſtices which they haue, two being higheſt in ♈ & ♎, and two loweſt, in ♑ & ♋: 3. In their continuall Equinoctialles: 4. In their two Winters, and two Somers.

Thoſe that haue their ſituation betweene the

meanes and extremes, do (as the former) differ from the rest: 1. In the double passage of the ☉ ouer their heads, but not in the heads of ♈ & ♎: 2. In their foure shadowes and Solstices, although not happening at the same time, as in former situation,

Those that haue their situation in the extremes of the burning zone, do differ from the other: 1. In that the Sunne commeth but once vnto their Zenith: 2. in the length of their greatest day, which is 3. ho. $\frac{1}{2}$.

Those places that are situated within the temperate Zone, are either in the extremes, or in the meane.

The extreme spaces are those, that are vnder either the trop. of ♋, (wherof we spake before) or the Arcticke circle.

Those that are vnder the Arcticke circle do differ frō other: 1. In that they haue the Zodiake coincident with their Horizon, and the pole therof with their Zenith: 2. In that the signes do arise vnto them either most swiftlye, or most slowelye: 3. In the length of one day, consisting of 24 howers.

Those that are situated within the meane spaces of the temperate zone, do differ from others: 1. In their verticall point, which the Sunne neuer cometh vnto: 2. In their shadowes, which are onlie 3.

Those places that are situated within the frozen Zone, are either in the meane spaces, or in the extremes.

Those that are within the meane spaces of the

frozen zone, do differ from other: 1. In the interſection of the Zodiake, and the Horizon in equidiſtant pointes: 2. In that ſome portion of the Zodiake, is alwaies either aboue the horizon, or vnder the ſame.

Thoſe that are within the extremes of the frozen zone, are either vnder the Arcticke circle, (whereof we ſpeake a little before) or vnder the pole.

Thoſe that are vnder the pole do differ from other:

1. In their Horizon, which is all one with the Equinoctiall: 2. in their daye, which is halfe a yeare, by reaſon that the one moitie of the zodiake doth alwaies appeare aboue the horizon.

Of the diuerſitie of the names of the inhabitantes. Chap. 40.

THe inhabitants of the earth compared one with another, haue diuerſe appellations, by reaſon aſwell of the ſhadowes of the ☉, as of the Horizon, or paralleles and meridians.

The ſhadowes caſt by the ☉ vpon the earth at Noone, are either infinite, or none at all, or els they are finite.

The ſhadowes that are infinite or equidiſtant vnto the beame, are caſt in the frozen zones, whoſe inhabitants are called *Periſcii*, that is ſhadowed round about, becauſe their ſhadowes do goe in compaſſe round about them.

Thoſe that haue no ſhadowes at Noone tide, are in the burnt zone, whoſe inhabitants are named either *Aſcii*, becauſe when the ☉ is in

their

their Zenith, they haue no shadowe at all: or els, *Amphiscii*, hauing 2 shadowes, the one Septentrionàll, when the Sunne goeth from them toward the South, the other Meridionall, whé he passeth from them toward the North.

Those whose shadowes are finite, are named *Heteroscii*, as hauing but one of those shadowes, either Septentrionall, as in the Septentrionall temperate zone, or els Meridionall, as in the Meridionall temperate zone, whereof *Lucane* maketh mention.

As concerning the inhabitants of the world, whose comparison one with another standeth vpon the Horizon, or the paralleles and Meridians, we haue 5. thinges to consider

1. Some of them haue the same sensible Horizon, whome *Albertus* calleth *Simul habitantes*, dwelling together.

2. Some of them do dwell vnder the opposite pointes of the same parallele, and are called proprelie by the Greekes *Periœci*, as if you would say, dwellers about, of the Latines *Transuersi*, dwellers on the other side.

3. Some of them dwell vnder the same parallele, but not in the opposite pointes, hauing a diuerse Longitude, whome *Albertus* calleth circulare dwellers.

4. Some of them dwell vnder the pointes of the same semimeridian equidistant from the Equator, hauing a contrarye Latitude, and are called *Antœci*, or *Antomi*, also oblique inhabitantes.

5. Some of them do inhabite an equall, or also

the

the ſame parallele, but vnder the pointes of the Meridian diametrallie oppoſite, and are called *Antipodes, Antichthones*, and oppoſite.

The diſtinction of the Surface of the earth, according to the length of the daies. Chap. 41.

FOr the more exact knowledge of the longeſt daies in euery place of the world, ſenſiblie changing them ſelues, the Aſtronomers haue deuiſed, the diſtinction of paralleles, and of Climates.

The paralleles offer vnto our conſideration, their definition, and their ſupputation.

They are defined to be circles diſtinguiſhing the climates, and diſtant one from another at the moſt, but quarters of howers.

Their ſupputation is diuerſe, deliuered by 3. ſortes of Geographers.

1. By the common Geographers, which do diſtinguiſhe the ſpace of the earth from 12. gr. 45. mi. vnto 50. gr. 30. mi. into 15. paralleles, attributing vnto eache one ¼ of an hower.

2. By the Mariners, who in like manner do recon 14. paralleles, diſtinguiſhed by quarters of howers, from the Equator vnto 45. gr: but then they proceede by halfe howers, vnto the 19. parallele: and then by adding on whole hower, they come vnto the 21. prrallele.

3. By the more ſubtile Geographers, who make 48. ſeuerall paralleles, from the Equator toward the pole of the world, vnto the 66. gr. 30. mi. of eleuation: and from thence augmenting them

them by dayes, they adde 20. more.

The climates are to be cousidered in their definition, in their diuision, in their number, and in their magnitude.

The definition is thus: A climate is a space of the earth, included within 3. paralleles, conteining the difference of $\frac{1}{2}$ an hower.

Their diuision, is either general, or particulare.

Their generall diuision it that, in regarde whereof some of them are called Northern climates, and some Southerne.

The Northern climates haue their propre names, deriued from the places through the which they do passe.

The Southerne climates are those that are named by the contrarie.

Their particulare diuision is that, in regarde whereof euery one of them is diuided into 3. paralleles, the first, the middlemost, and the last parallele.

Their number is knowne through the supputation of the paralleles.

Their magnitude is inequall, aswell in respect of their Longitude, as of their Latitude.

Their Longitude toward the Equator, is greater, by reason of the greater compasse of circles: and towarde the poles it is lesse, by reason of their lesse compasse.

Their Latitude is inequall, in respect of the space of degrees, that halfe an hower doth conteyne, and it is greater about the Equator, by reason of the almost equall compasse of the degrees: and lesse about the poles, by meanes of the

the narrowe inclination of the roundneſſe of the earth.

Of the light, and of the ſhadowes, and their differences. Chap. 42.

FOraſmuch as there hath bene often mention made of the ſhadowes, it ſhall not be amiſſe if we ſet before your eyes, the methodicall deſcription thereof: and ſeeing that contraries are by their contraries made more manifeſt, we will declare the nature of the light, and of the ſhadowe.

The nature of the light is ſhewed by the definition, the diuiſion, and the cauſe thereof.

It is defined to be the image, or the beame of the bright light.

It is diuided, either into the firſt and principal, or the ſecondarie and reflexed light.

The firſt and principall is that, which proceedeth directly from the light body, and is either perpendiculare, or oblique.

The perpendiculare light is that, by the fall whereof right angles are made.

The oblique light is that which falleth not at right angles.

The ſecondarie or reflexed light is that, which from one ſide ſpreadeth it ſelfe on al parts, without any falling of the beames.

The cauſe of the light is either the Elementall bright light, whereof here we teach nothing, or the celeſtiall.

The celeſtiall bright light, is that which either

causeth the shadowe, as that of the ☉, of the ☾, of ♀: or els, which hath no power to make any shadow, as the light of the of the other Starres.

The nature of the shadowe is declared by the definition, and by the diuision thereof.

It is defined to be a light diminished: or a certen forme of a darke body, alwaies contrarie to the body casting the light.

The diuision thereof is two folde, the one drawen from the coastes of the worlde, the other from the position of the darke body.

The shadowe taking the appellation from the coastes of the worlde, is of 2. sorts.

The one is extended toward some coaste, and it is either Orientall, or Occidentall, or Meridionall, or Septentrionall.

The other is perpendiculare, or a right shadowe by a perpendiculare, which is not extended, as it is vnto those, that haue the ☉ in their Zenith.

The diuision deriued from the position of the darke bodie is that, in respect whereof one shadowe is called right or extended, another reuersed.

The right shadowe is that, which is caused by the darke bodie, perpendicularelie erected vpon the terrestriall plane.

The reuersed shadowe is that, which is caused by the darke bodie, that is parallele vnto the Horizon.

Of the Eclipſes in generall. Chap. 43.

OF al the apparéces of the heauen, the Eclipſe is the principall: and therefore we will declare the generall reaſon of the ſame, by the definition, and by the termes thereof.

The definition is either barelye and planelye propounded, or els it is more largely expreſſed.

The plane definition thereof is that, whereby it is defined to be the taking away, or the hindering of the bright light, ſo that it cannot come vnto the eye.

The larger expreſſion thereof is thus: vnto euery Eclipſe there belong 3. thinges: a bright heauenly light, our ſight, and a ſhadowy or dark bodie.

The bright heauenly light was formed by the Creator, for the expelling of ſhadowes, and it is twofolde, a greater and a leſſe.

The greater, is that of the ☉, ſhining of it ſelfe.

The leſſe is that of the ☾, caſting about (as out of a looking glaſſe) her light borowed of the ☉.

Our ſyght is diuerſe, according to the diuerſe poſition thereof, vppon the round compaſſe of the earth.

The ſhadowy or darke bodie is alſo twofold, viz. the bodie of the ☾, the one moitie whereof the ☉ enlighteneth not: and the earth, whoſe ſhadow is alwaies oppoſite vnto the ☉.

The termes of the Eclipſe, which in this kinde

of doctrine the Astronomers do vse, are in number three.

The first is the quantity of the bodie either of the ☉, whose visuall diameter (as a chord) doth subtende in the Auge of his eccentricke 31. mi. and in the opposite thereof 31. mi. or else of the ☾, whose apparent diameter doth in the Auge of her eccentricke and epicycle, subtende 29. mi. and in the opposite thereof 36 mi.

The secõd is the quantity of the shadow, which the motion of the ☉ through either *Absis*, doth cause to varie, aswell in regard of the longitude from the surface of the earth, which for the most part conteineth 276. semidiameters of the earth, as also in respect of the latitude, which also in the place of the ouerthwart crossing of the ☽ is diuers, both in respect of the ☉, beeing in either *Absis*, and of the ☾ which in her oppositiõ is either in the *Auge* of her epicycle, and then it is 75. mi. or in the opposite thereof, and then it conteineth 94. mi.

The third is the quantity of the termes eclipsed, either of the ☾, which are 15 partes 12 mi. or of the ☉, by reason of the *Parallax* of the latitude of the ☾, being either about the South, and it is 11. gr, 22. mi. or about the North, being 20. gr. 40. mi.

The particular description of the Eclipses. Chap. 44

THe beames therefore both of the ☾ and of the ☉, may be hindered from shining vpon the earth.

The

The beames of the ☾ being borowed, may bee hindered by the comming of the earth, and the ſhadow thereof, betweene the ☉ and her, and that maketh the Eclipſe of the ☾, whereof wee may conſider the time wherein it happeneth, & the continuance thereof.

The time of her eclipſe is when ſhee is at the full, when the ☉, being in oppoſition with the ☾, driueth the ſhadowe either according to the longitude, as euerye moneth it commeth to paſſe, or els according to the latitude, whiche falleth out when the ☾ is either within or nigh vnto the *Nodi*, that is, the head and taile of the Dragon.

In the continuance it is to be conſidered, that the ſtaye of the ☾ in her darkening, is either long or ſhort.

The long ſtay is with her whole bodie, when her oppoſition falleth out preciſely in the *Nodi*.

The ſhort ſtay is when ſhe is diſtant from the *Nodi*, and then her body is darkened either all, or halfe, or leſſe then the halfe.

Shee is darkened wholly, when ſhee hath her latitude leſſe then the ſemidiameter of the ſhadow, by the quantity of her apparent ſemidiameter.

Shee is darkened halfe, when ſhe hath her latitude equall vnto the ſemidiameter of the ſhadow.

Shee is darkened leſſe then the halfe, when ſhe hath her latitude greater then the ſemidiameter of the ſhadow.

The beames of the ☉ are hindered by the interpoſition of ☾, and that is called the Eclipſe

of the ☉, wherein wee may haue consideration of the tyme wherein it happeneth, the diuersitie thereof, and the difference thereof from the Eclipse of the ☾.

The time wherein the ☉ is eclipsed, is in the new ☾, at which time she seemeth to haue a diametrall coniunction with the ☉, aswell in respect of longitude, as of latitude.

The diuersitie thereof is, in that it is eclipsed either wholly, or lesse then all:

The ☉ is wholly eclipsed, when the ☾ beeing in visible cõiunction with the ☉, is in the *Nodi*.

The ☉ is eclipsed lesse then wholly, when as the ☾ being in visible coniunction with the ☉, hath latitude, but yet lesse then 35. mi. or els, when the semidiameters of the ☉ and the ☾ are ioyned together.

The difference of the Eclipse of the ☉ from the eclipse of the ☾, is in regarde of the time, the continuance, and the vniuersalitie.

The difference considered in the time, is in that the ☾ is darkened in the oppositiõ, but the ☉ in the coniunction.

The difference cõsidered in the continuance, is in that the darkening of the ☾ falleth out to be long, but the Eclipse of the ☉ but short, by reason of the small quantity of the ☽, aud the swifte motion thereof.

The difference considered in the vniuersalitie, is in that the Eclipse of the ☾ is euery where seene, but the Eclipse of the ☉, in one onlie parte of the earth, namely in that, which is couered by the shadowe of the ☽.

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